WIRE & WIRE PRODUCTS

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PUT yourself in the place of our MOTOBLOC repeat customers. Suppose that you indirectly heard about the many advantages of the MOTOBLOC and decided to try a couple of these MOTOBLOCS out to see if they really "delivered the goods."

Then suppose you found: (1) that you actually increased your former production from 20% to 100%; (2) that it was possible for the same type of machine to handle varied production at the one best speed to suit the different sizes or quality of wire being run; (3) that the protective devices practically eliminated the accident hazards; (4) all of which required fewer machines and greatly reduced floor space.

Then you would understand why repeat orders follow MOTOBLOC installations and why one Company after operating 30 MOTOBLOCS in one of their mills in which group type blocks were used, completely equipped their new mill with 88 MOTOBLOCS and just lately have added 20 more making a total of 138 machines. We shall be glad to send you the detailed facts.

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CUYAHOGA FALLS, OHIO

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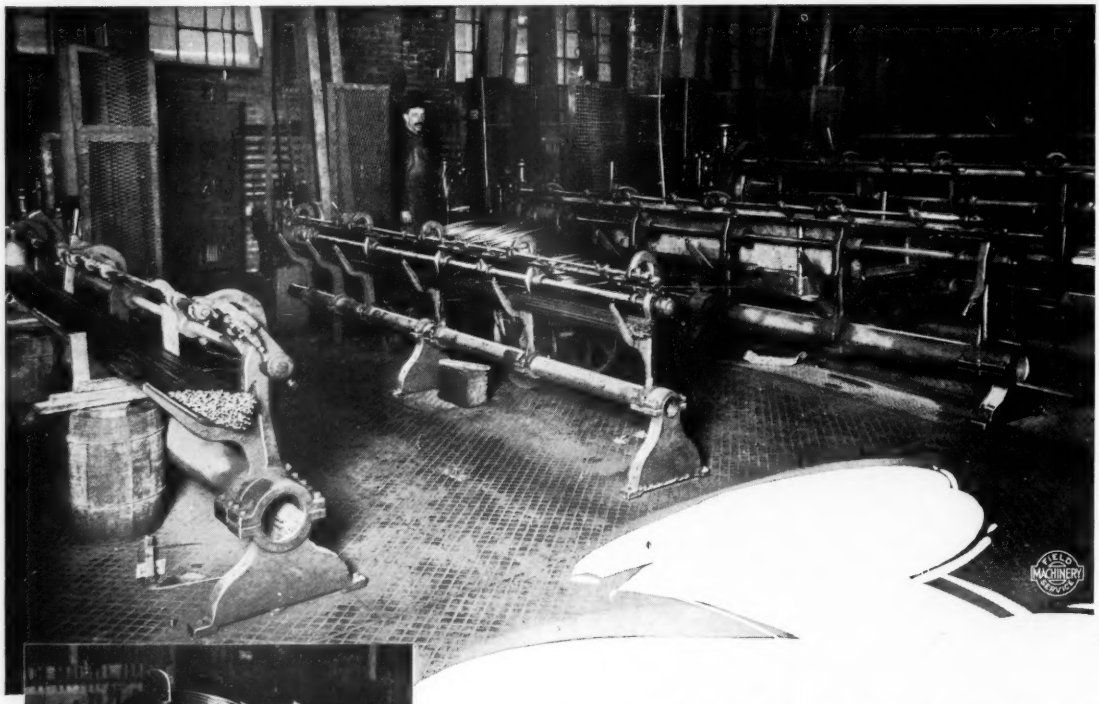
Manufacturers of Vaughn MOTOBLOCS

Continuous Copper Wire Drawing Machines and other wire mill equipment for pointing, cleaning, baking, patenting and heat-treating, galvanizing and tinning, etc.

VAUGHN MOTOBLOCS

PATENTS APPLIED FOR

Twenty Years of Shuster Service



One of the large Brass and Copper Companies use

Shuster Automatic Wire Straightening and Cutting Machinery

exclusively for cutting brass wire, 11/16″ down to 3/32″ diameter into convenient lengths for the trade.

Beside the two 20 year old Machines shown they have several which have been added at later dates.

Shuster Straightening and Cutting Machines are made in all sizes and styles; they require no skilled labor to operate and can be handled in batteries.

They are large producers—for instance a ¾″ size cuts up 10 tons per day, while in another plant drill rod is cut up to 6¼″ lengths at the rate of 2800 per hour.

The F. B. SHUSTER COMPANY
New Haven, Conn.

Straightener Specialists Since 1866

WIRE & WIRE PRODUCTS, Vol. 3, No. VIII, August, 1928. Publication office, 59 East Washington Avenue, Washington, N. J. Executive office, 551 Fifth Avenue, New York, N. Y., by the Quinn-Brown Publishing Corp., Richard E. Brown, President; Frank Quinn, Secretary and Treasurer. Subscription price: U. S. and Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office at Washington, N. J., under the Acts of March, 1879, and copyright, 1928, by Quinn-Brown Publishing Corporation.

ONE of the newer metals which will be watched with interest by wire manufacturers and formers as it becomes more readily available commercially is Beryllium, hardest and most inert of the light metals. As briefly described in one of the research Narratives of the Engineering Foundation, the metal has rather remarkable properties.

Beryllium weighs only two-thirds as much as aluminum and but little more than magnesium and is considerably less than twice as heavy as water. Scratching glass easily, it is one of the hardest of metals. Its expansion and contraction with changes of temperature are almost the same as those of iron —again diverging from the other light metals. It takes a high polish, remains untarnished in air, and is only slightly attacked by influences which take heavy toll of aluminum and magnesium. Its color is a gray closely resembling steel, and its melting point, 1285° C. also approaches that of steel. Heating to 600° C. does not materially affect it.

Beryllium will probably have its first wide us in alloys. To aluminum it adds strength and resistance to corrosion; in iron it acts as a powerful hardening agent; and its stiffening effect on copper is said to be unequalled. As late as 1922 Beryllium sold at the rate of $5000 per pound, but only a few grams were available. It now seems possible that by 1931 the present price of about $50 a pound may be reduced to $10, as progress is made in refining methods and economical use of by-products.

From our post of observation it is not uncommon to see today's laboratory experiments become tomorrow's matter-of-fact shop routine. The editorial scope of *Wire & Wire Products* includes both and all the stages between, hence our interest in reporting anything that is or promises to be of significance to the industry it serves.

The Publishers

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 3 **August, 1928** **No. 8**

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WIRE
& WIRE PRODUCTS

Vol. 3 AUGUST, 1928 No. 8

Further Mechanical Tests of Wire

Methods and apparatus for determining ultimate stress, yield point, elastic limit and torsional resistance

By J. D. Brunton

Brunton's Research Laboratory, Musselbergh, Scotland

THE following are definitions of the various mechanical properties of steel wire as laid down by the British Engineering Standards Association:

(1) The Elastic Limit.

The elastic limit is the point at which the extensions cease to be proportional to the loads.

In a stress strain diagram plotted to a large scale it is the point where the diagram ceases to be a straight line and becomes curved.

(2) The Yield Point.

The yield point is the point where the extension of the bar increases without increase of load.

The true yield point is only found in soft iron and mild steel. In hard steels tempered at various high temperatures there is a close approximation to a yield point or possibly even a small true yield point, a considerable extension occurring with a very small increase of load.

In last month's contribution Mr. Brunton discussed the various types of machines in use for testing the tensile strength of wire, their comparative advantages and most effective use. The accompanying article will be followed by other contributions from the same author on the subject of wire testing devices and the technique of operation.

(3) Ultimate Stress.

The ultimate stress, often called Maximum Stress or Breaking Stress, is the greatest load ascertained at any time by the loaded test piece, expressed as a stress per unit area of the original cross section of the test piece.

(4) Elongation.

The elongation is the increase of length of the broken specimen measured between the gauge points. This is always expressed as a percentage of the original gauge length.

(5) Reduction of Area.

The reduction of area is the difference between the original cross-sectional area and the area of the cross-section at the fracture. It is always expressed as a percentage of the original area.

To arrive at all these properties with the exception of the elastic limit requires no additional apparatus other than a pair of dividers, a good scale, and a point micrometer.

Elongation.

It is usual, in measuring the elongation that the wire suffers during test, to record this figure in relation to some definite length of the wire to be tested and to express it as a percentage of that length. On the Continent the practice is to make this gauge length 200 millimetres, and the percentage elongation works out at from 7½% on a soft wire to about 1% on a hard wire. In this country the gauge length is 8 inches, but it is usually confined to sizes of wire covered by ordinary rope wire.

In the bigger sizes of wire, the gauge length is one which bears a relation to the cross-sec-

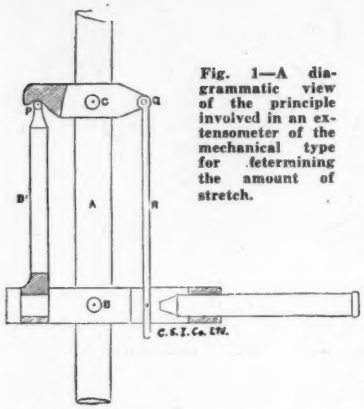


Fig. 1—A diagrammatic view of the principle involved in an extensometer of the mechanical type for determining the amount of stretch.

tional area of the wire. The most suitable figure, which has incidentally been adopted by the British Engineering Standards Association, is 45 area and on this gauge length the percentage elongation is approximately the same, even if the test piece be turned down to a much smaller diameter. Tests recorded on this gauge length give a figure of from about 7% on very hard wires to about 34% on very soft wires. This gives a much wider range to work on than the larger gauge length and assists better in sorting out the various grades if wires.

Yield Point

For determining the yield point of the steel wire a pair of dividers is called into play. Two marks are made on the wire roughly four inches apart and during the loading of the wire this length of four inches is constantly checked with the pair of dividers, so that, the moment a certain amount of yield has taken place in the specimen, this amount can be detected with the dividers.

An amount that would be considered a yield in the specimen would approximate to .01 per cent on a gauge length of 4 inches, so that, when the specimen has stretched to the extent of say .04 inches on a gauge length of 4 inches, the load should be noted and recorded as the yield point of the material.

The reduction of the cross-sectional area of the specimen after test is merely a matter of measurement both before and after.

The general procedure then for a test to include all these details is, first of all, to consider the gauge of the wire, also what tests are expected from the metal. If the wire is small in diameter then very likely the gauge length of the material will be, say 8 inches or 200 millimetres. The wire should, first of all, be polished with a piece of fine emery paper. This gives a series of very fine scratches running in the direction of the wire. The wire should be gauged and its diameter noted, and then marked off in a series of divisions, say a quarter of the gauge length. This would mean that the wire would be divided into sections of 2 inches long or 50 millimetres right along the whole length of the wire, which should be at least twice the length of the portion to be under test.

If the wire were of thicker size it would be possible to make these divisions by making a small depression on the surface by means of a centre-punch and then, using the dividers as a scriber, mark off the requisite amount by using the centre-pouch holes as centre and making a slight scratch across the wire, repeating the procedure going along the rod. If the wire is of a small diameter this cannot be done, as the surface of the wire would be easily damaged by making a punch mark: consequently another method has to be resorted to.

There are several methods of doing this and the following is a good practical method. The wire should be first carefully straightened and then laid along the scale and clamped down firmly. Marks may be made on the wire by means of a very sharp pencil which has been previously dipped in concentrated solution of copper sulphate and water. The copper sulphate can flow quite easily from the pencil with only a very light touch, so that the point will not be worn down by movement across the steel wire. The thin line of liquid copper sulphate that is left on the wire will react with the steel and deposit pure copper which will appear as a fine pink line easily visible on the wire. The old method of marking the wire by means of India ink is not so reliable, as the ink is liable to crack off with the possibility of spoiling the test.

The reason why the gauge length is sub-divided is that there is always a possibility of the specimen breaking exactly on the gauge mark, in which case it would be almost impossible to get a true estimate of the elongation.

Careful Handling Required

In placing the specimen in the grips care should be taken that those marks on the wire which are within the grips should in no way be touched by the grips. This ensures that, if the specimen should break in the grips, then the marking will be intact and the elongations still capable of being estimated. At the commencement

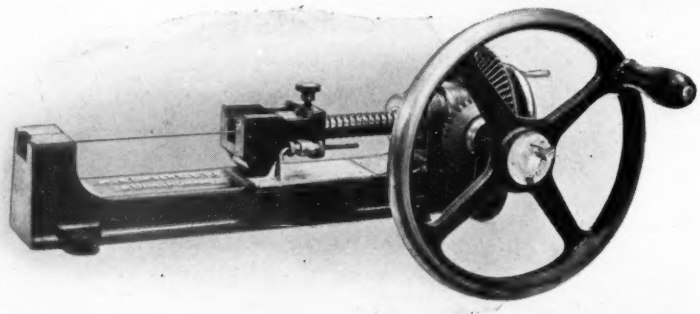


Fig. 2—A machine for testing the percentage elongation on a specific length of wire. The strain is applied through bevel gears by a hand wheel and is recorded on a graduated scale.

of the test the loading should be slow and gradual, so that the operator may carefully note when the requisite .04 of an inch elongation has been attained. After this figure has been recorded loading may be put on rapidly in the usual way until fracture occurs.

The broken pieces of wire should then be taken back to the scale and fitted together and the total extension over and above the original 8 inches noted, the amount being recorded as a percentage.

Just after the yield point has been reached the wire commences to reduce in diameter at one particular spot. This continues appreciably right up to the breaking load of the metal, so that at the point of fracture the wire has considerably reduced in diameter and has formed what is called a "waist." The measurement of this reduced diameter is effected by means of the point micrometer and the difference between the diameter of the original and the new diameter is expressed as a percentage of the original diameter. To complete the test, the two loads, the yield point and the breaking stress are expressed in tons per square inch of cross-sectional area by dividing the number of lbs. load by the original area and by 2,240.

The determination of the elastic limit calls for greater accuracy than that of the yield point, as it necessitates that the elongation of the specimen be measured while the specimen is being strained elastically.

The total elongation of a wire on a gauge length of four times the square root of the area is a quantity that can be easily measured with a pair of ordinary dividers. As the elastic stretch of a wire is extremely small when compared with a total stretch of a wire after fracture,

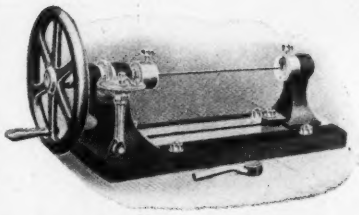


Fig. 3—A torsional tester for wire in lengths of from 3 to 17 inches. The dial counter records the number of twists the wire will stand before breaking.

an instrument of great precision must be used to determine the very small amount of stretch that the specimen undergoes during its elastic deformation prior to permanent deformation before fracture.

These instruments — extensometers—are able to record accurately differences in length of a specimen equal to 1/100,000 of an inch. They are as a rule of two types:

(1) Mechanical.
(2) Optical.

In the case of the mechanical instruments the small increases in extension are measured by:

1. A micrometer screw.
2. An indicating dial.
3. A microscope.
4. A series of levers actuating a pointer.

Types of Extensometers

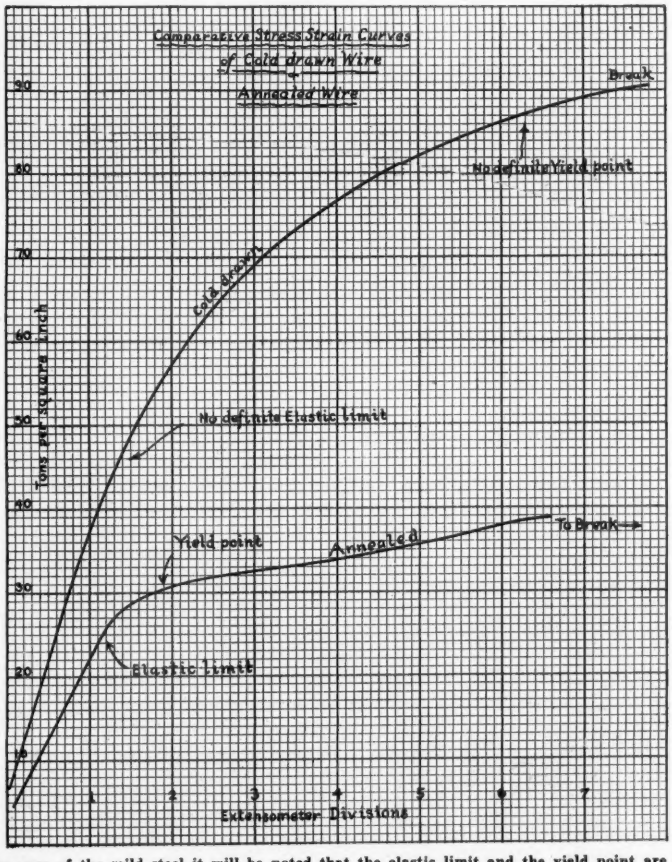
The optical extensometers usually depend upon some form of optical lever, such as a rotating mirror. Extra magnification is obtained either by projecting a beam of light from this mirror to a distant scale, or by observing the image of a scale in the mirror from a distance by means of a telescope.

The optical instruments are generally of greater accuracy.

Figure 1 is a diagrammatic view of the principle involved in an extensometer of the mechanical type designed by Professor Ewing and manufactured by Cambridge & Paul.

There are two clips B and C, each attached to the test-piece A by the points of two set-screws. The clip B has a projection B^1 ending in a rounded point P which engages with a conical hole in C; when the bar

(*Please turn to page 277*)



In the case of the mild steel it will be noted that the elastic limit and the yield point are well defined, whereas in the case of a hard drawn wire the elastic limit is extremely low and the yield point coincides with the breaking load.

Wire as fine as mm 0.003 is used to make filament coils for some electric lamps. To check mechanical defects in wire drawn down to a smaller diameter than a human hair requires the use of microscopes.

Drawing Tungsten Wire for Filaments

The most important wiring unit in electric light bulbs and radio tubes presents peculiar drawing and forming problems

THE practice here described is that followed in the Bloomfield, New Jersey, plant of the Westinghouse Lamp Company, where tungsten is refined from imported ore and made into wire for filaments. Interest in the production and manufacture of the metal has been stimulated recently by the decision of the United States Tariff Commission to investigate the standing of native as against the imported ores now chiefly in use.

TUNGSTEN ore, in the form of dark brown earth, is imported direct from China as concentrates, and at every point in its subsequent processing, drawing and forming is under the direct control of the manufacturer of electric lamps and radio receiving tubes.

The first step is to heat the powdered ore with sodium hydrate, which extracts the tungsten contained. This solution is put thru a purification process which terminates with the precipitation of tunstic acid (H_2WO_4). After drying and heating a yellow oxide (WO_3) is obtained which is reduced to metal by heating with hydrogen in a special gas fired furnace.

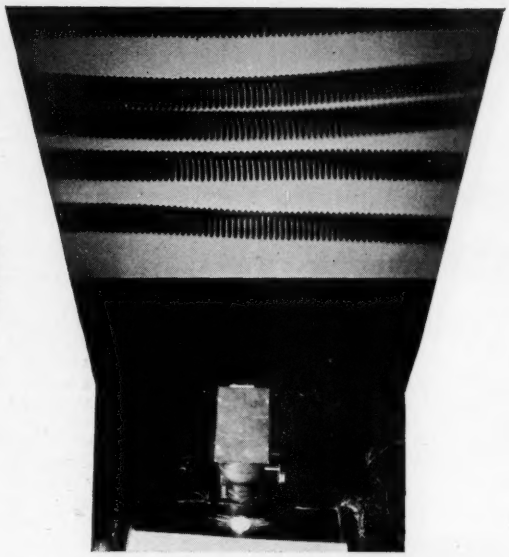
Tungsten melts at about 3300°C. It deteriorates rapidly when heated in air. For this reason, all heat treatments are given in the presence of dry hydrogen and during the subsequent drawing the metal is protected by a graphite coating which also serves as a drawing lubricant.

After reduction, the metal which at this stage is in the form of a gray powder, is formed into slugs about twenty-four inches long and a half inch square under hydraulic pressure of twenty tons to the square inch. The pressed slugs are heated in an electric furnace to give them mechanical strength and then subjected to a high current for a period of twelve minutes, in the presence of hydrogen. This treatment welds the particles together in a coherent crystalline body. This operation is a substitute for casting in ordinary metals and the product may be considered equivalent to a metal ingot in the ordinary sense. The next operation on the bars, which are now rigid enough for handling but brittle, is hot rotary swaging which is done in successive steps, the temperature being gradually reduced as the size diminishes. The rods are then ready for the wire block.

From a No. 14 size (mm 1.63), tungsten wire is drawn to various degrees of fineness regulated by the wattage of the lamp in which it is to be used. The diameters range down to a scarcely visible size of mm 0.003. In this size the tensile strength is 500,000 pounds to the square inch, or about the same as piano wire. Hot drawing through diamond dies is the process used, and there are over ninety passes required for the smallest sizes. Elongation between passes average 13% to 15%.

The graphite lubricant pro-

tects the metal from the action of the air by forming a baked protective coating in the heat of the drawing furnaces. Cleaning is done by heating in hydrogen gas, caustic hydrate, or electrolysis, and shop test is controlled by weight. If specimens are off size the variation is detected by a departure from a given standard weight per unit of 200 mm of length. Drawing is slow and virtually continuous throughout. The refractory nature of tungsten is reflected in working so it is necessary to exercise precise control of drawing temperature and other factors or excessive breakage is obtained.



Microscopic examination is supplemented by the use of the micro-projectoscope. The filament coils, which must not touch, nor be flattened, twisted or warped, are magnified 100 times and the image thrown on a screen.

Practically all tungsten filaments, however fine, are helical formed, resembling miniature springs. For the most part the coils are formed by automatic machines on a steel mandrel which is later dissolved in an acid bath leaving the coil, though successful results are now being obtained with new machinery that forms coils without the use of a mandrel and delivers them in appropriate lengths.

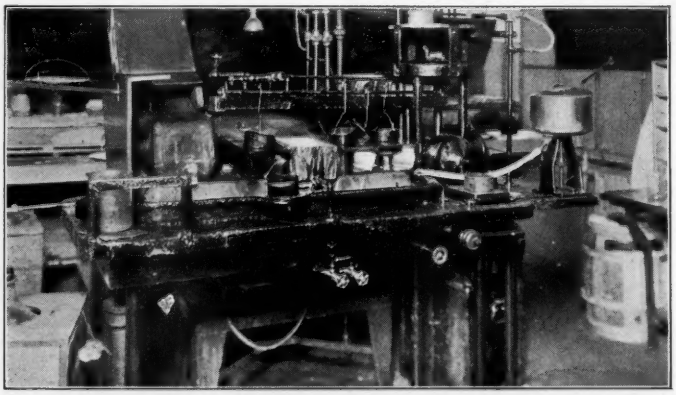
The formation of the filaments, that is, the loops and angles that are to be seen in the bulb of a finished lamp, is done by hand with jigs, pliers and heat.

The filament, of course, is the only element in a lamp or radio tube that glows when the current is passed through it. The other wires, all made in the same shops, include the nickel lead-ins, molybdenum supports for the filaments, and a very short but important bit of special formula wire which is electrically spot welded to the lead-in on one side and the copper which extends outside the bulb. The most useful property of this special wire, which is drawn down from copper-sleeved rods, is its coefficient of expansion which approximates glass. The material is sealed in the stem of the lamp or radio tube and completes the circuit from the base thru the glass to the filament.

The testing of the very delicate filaments that must be formed before mounting in the glass bulbs has resulted in the use of some ingenious mechanical checks to insure perfect separation of the coils and to detect defects that might cause twisting or warping when the filament is heated. Microscopic examination is supplemented by a Micro-Projectoscope which throws an enlargement of the coil on a screen so that imperfections are magnified and easily detected.

In electric light bulbs there are, in addition to the filament, wire hooks to support it and the lead-ins. Vacuum radio tubes contain a grid and plate in addition to the filament. After the bulbs are exhausted, sealed, and the bases baked on with cement, the electrical contacts are dipped in molten solder and the bulbs or tubes are ready for a variety of inspections.

From this point on, the steps involved have more and more remote relation to our particular interest in tungsten wire drawing and forming, but the special testing machine devised for insuring radio tube quality deserves at least a mention. The tubes are seasoned, by operation, to set the electron emission at a predetermined figure, and an automatic mechanism discards any deficient in filament current, electronic emission and quality of vacuum. Its capacity is 6000 tubes an hour and it is so sensitive that it detects variations of two hundredths of a milliampere.



A dish of acid under the chimney at the left of the picture is used to dissolve the steel mandrel on which the filament is wound. The other dishes contain baths in which coils are oscillated. (Photos by Courtesy of Westinghouse Lamp Co. and the Scientific American)

A Few Fundamentals In Cost Accounting

Serious underestimates of manufacturing costs may be avoided by departmentalizing factory overhead

By J. V. Montague

Assistant Comptroller, Scovill Manufacturing Company

MR. Montague's address was given at one of a series of meetings arranged jointly by the Hartford Chapter of the National Association of Cost Accountants and the Manufacturers' Association of Connecticut in an effort to reduce unintelligent competition by promoting wider use of sound cost accounts. Our selection will be of particular interest as coming from a manufacturer of a great variety of finished wire products.

WHETHER you are running a mine, a machine shop, a brass mill, a screw machine factory, or any other kind of factory, you are confronted by the same accounting problems. Methods of recording details will differ, the names of your accounts will differ, and you may have operations to perform in one business never heard of in the others. Still the same accounting principles apply alike to all.

You may have grown up in your factory; every operator, every machine, every operation may be known to you from beginning to end; you may have swept the floors and by progressive stages passed through every department until now you are the directing head, possessed with a fund of knowledge concerning your business that no other man has, but unless you know your costs you do not know your business.

Elements of Costs

At a previous meeting the elements of costs were described as being composed of the following:

Prime Costs
1. Direct material
2. Direct labor

Overhead Costs
1. Indirect labor
2. Operating supplies or indirect materials
3. Depreciation
4. Repairs and upkeep
5. Power
6. Heat, light, rent, etc.

While each of those elements is susceptible of further extension or expansion, each one is usually classified and arranged by departments in the order given. The first one is "direct materials." The ordering, the receiving, the handling of physical stock and the clerical work connected with the accounting for direct materials, properly belong in a discussion of inventory control. That phase of accounting is an element of cost the value of which is generally well known unless a company engages in both mill and manufacturing operations. Then the problem is more complicated. However, under ordinary conditions, the cost of material is easier to allocate than is either direct labor or overhead. It might be said that direct is easy to handle. All that is necessary is to charge the wages paid to productive men to the jobs, or processes, or classifications on which they are working. It sounds simple in theory but practice develops many complications.

I believe that the greater part of all manufacturing concerns have estimating departments, or departments where the cost of manufacturing all products is computed before operations on those products begin. The labor connected with every process in the fabrication of an article, with every operation through which it passes and with every conceivable thing which happens to it before it is turned into a finished piece of goods, is collected and priced at an estimated figure. When operations on that article start in the factory, only the wages included in the estimate as a part of the cost of that article, and no more, should be charged as the direct labor cost of the article.

Direct Labor Distribution

Following the incidence of operations, timings should be made on each operation, estimates should be revised, then they become standards. The cost of any operations omitted from the estimate or standard because not foreseen; overtime costs and the cost of duplicate sets of tools due to customers' demands for accelerated production; the cost of damages occurring somewhere in its movement through the factory or to some unskilful performance; and the cost of any work unanticipated at the outset, should be charged to special overhead ac-

	Pieces	Cost	Selling Price	Profits
Article No. 1	1,000,000	$56,250.00	$61,875.00	$5,625.00
Article No. 2	100,000	10,500.00	11,550.00	1,050.00
Article No. 3	100,000	3,875.00	4,262.50	387.50
Article No. 4	500,000	25,000.00	27,500.00	2,500.00
		$95,625.00	$105,187.50	$9,562.50

(A). The manufacturer with the above figures before him showing a profit of 10% on his factory costs felt that he was making progress until his accounting department produced a statement showing a loss of $1,562.50.

	Dept. A	Dept. B	Dept. C	Dept. D	Total
Direct Labor	$1,000	$5,000	$1,000	$3,000	$10,000
Overhead	4,000	7,500	1,250	2,250	15,000
	$5,000	$12,500	$2,250	$5,250	$25,000
Overhead Rates	400%	150%	125%	75%	150%

(B). After the manufacturer's factory costs have been broken down into four departments, the figures showing operating costs account for losses that were not revealed in the general overhead figures.

counts or accounts designed to show extraordinary overhead items, even though the men who performed any one or all of these operations are classed as producers.

If that is the procedure outlined for the cost departments, and to my mind it is the correct procedure, some difficulties will be encountered in correctly distributing direct labor. If defects are discovered in the article after it has been assembled from two or more parts, and if to repair it, it is necessary to break down that assembly and place these parts back into regular manufacturing channels where more of the same work, perhaps emanating from the same order, is in process, it takes a perfect production control method and a 100% timekeeper to avoid confusion in the records. Not many concerns have either.

Labor Cost Confusion

Presented with difficulties of that kind, and that is only one of several which might be enumerated, it is readily seen that correct labor distribution is not an easy accomplishment. Some cost accountants would attempt to avoid the difficulty by charging all these additional costs to direct labor. If that is done, of course more labor gets into costs than is called for in the estimate, and the selling price is based upon the estimate. On the other hand, a lower cost in overhead is recorded. The increased labor cost is never compensated by the decrease in overhead, as the additional costs were not contemplated either in the labor or overhead costs when the selling price was fixed. Costs would continually exceed the estimate in labor but the overhead would be lower, thereby reducing the overhead rate and thus preventing the establishment of a selling price based on an approximately true cost.

Suppose that the direct labor on an article is estimated to cost $1; that the overhead rate established by a practice which includes the charges for additional operations, overtime, reworking, etc., is 150% and that the material cost is $1. The estimated costs of that article would be $3.50. Now suppose that all of these additional costs are charged to direct labor and that this extra cost is 10c. That, we will say, is the common practice of a factory. The costs would then show direct labor to be $1.10 and overhead to be $1.40 or 127.3% of the direct labor costs. The 10c, however, is regarded as exceptional and unlikely to ever occur again, but the overhead rate of 127.3% and not 150% is the rate given to the sales department and there used in pricing future orders. The additional costs will never be recovered, future estimates will be too low, so will selling prices.

Comparison of Methods

Two factories compare overheads. One uses the first method and shows an overhead rate of 150%, the other follows the second method and is twenty-three points lower in the overhead rate. Apparently the second factory operates more efficiently than the first, but makes less money, and wonders why. There is a better chance of recovering costs through sales by following the first method, particularly when it is

(*Please turn to page 280*)

ARTICLE NO. 1
(1 000 000 pieces produced)

	Dept. A	Dept. B	Dept. C	Dept. D	Total	
Labor	$500	$1,250	$500		$2.250	
Overhead	2,000	1,875	625		4,500	200%
	$2,500	$3,125	$1,125		$6,750	

ARTICLE NO. 2
(100,000 pieces produced)

Labor	$2,500	$200	$1,500	$4.200	
Overhead	3,750	250	1,125	5,125	122%
	$6,250	$450	$2,625	$9,325	

ARTICLE No. 3
(100.000 pieces produced)

	Dept. A	Dept. B	Dept. C	Dept. D	Total	
Labor	$250		$300	$1,000	1.550	
Overhead	1,000		375	750	2,125	137%
	$1,250		$675	$1,750	$3,675	

ARTICLE NO. 4
(500,000 pieces produced)

Labor	$250	$1,250	$500	$2.000	
Overhead	1,000	1,875	375	3,250	162.5%
	$1,250	$3,125	$875	$5,250	

TOTAL ALL FOUR ARTICLES

Labor	$1.000	$5.000	$1.000	$3.000	$10,000
Overhead	4,000	7,500	1,250	2,250	15,000
	$5,000	$12,500	$2,250	$5,250	$25,000

When these costs are applied to the pieces sold and the income from each article sold set alongside these costs, quite a different result from that expected is revealed:

	Pieces Sold	Cost	Selling Price	Profit or Loss
Article No. 1	1,000,000	$67,500.00	$61,875.00	$5,625.00
" No. 2	100,000	9,325.00	11,550.00	2,225.00
" No. 3	100.000	3,675.00	4.262.50	587.50
" No. 4	500,000	26,250.00	27,500.00	1,250.00
		$106,750.00	$105,187.50	$1,562.50

(C). A comparison of this truer picture with the misleading one shown in (A) will repay the study it requires. The difference between the two is a difference between an imaginary profit and an actual loss.

Engineers Will Make Elaborate Study of Lightning

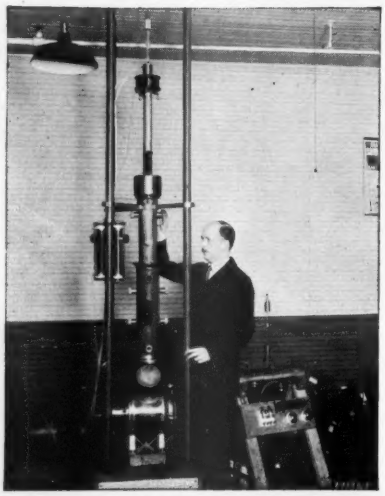
New scientific instruments are expected to disclose valuable facts about thunder bolts

ONE of the major battles of peacetime, the technical mind against lightning, is about to start in a lonely mountain spot in Tennessee. During the next six months, according to W. S. Rugg, Vice President of the Westinghouse Electric & Manufacturing Company, electrical engineers of his company, armed with every scientific device obtainable, will record each bolt and quirk of every thunder storm that plays around the crest of Chilhowee mountain.

Experts today are far from agreement as to the characteristics of lightning or its effects on high-power transmission lines. There is, for example a difference in opinion representing a ratio of 1,000 to 1, of what present day authorities declare to be the "rate of onset" of a lightning bolt. Existing data concerning the effect of surges induced in power lines by adjacent lightning strokes and that set up by direct hits is not accurate. This difference in opinion is one of the major factors that the installation is expected to make clear.

Modern Ben Franklins

The site where the apparatus is to be located, Chota, Tenn., has an average of 20 thunderstorms each month during the summer. The instruments used by the engineers, who will spend the next six months or six years, if necessary, on the job, will consist of Norinder oscillographs, osisos, klydonographs, cameras and other apparatus, not only to record but also to diagnose the effect of each lightning flash. This apparatus, to be installed on the power lines of the Aluminum Company of America, will cover a five mile stretch of wild terrain.



The Norinder oscillograph. A remarkable instrument that makes possible new and far-reaching studies of lightning.

Of supreme interest to scientists will be the installation of the Norinder oscillographs. These instruments are reported to be as superior to existing types of cathode ray oscillographs as the modern telescope is to those of Ben Franklin's time. They will reveal, according to engineers, characteristics of lightning which scientists have sought to discover for centuries.

Dr. Harald Norinder, inventor of the apparatus, ranks today as a foremost authority on lightning. This distinction is the result of eight years' study in Sweden as engineer and head of the Research Bureau of the Royal Board of Waterfalls in Stockholm. Last spring he personally brought his oscillograph here to demonstrate its abilities. It was arranged to have the apparatus made available and the Tennessee installation followed.

The installation of equipment will be made on either side of the highest peak of the Chilhowee mountains. A Norinder oscillograph will be located on either side of the mountain peak with two klydonographs installed one half mile from either side of each oscillograph. The oscillograph operates much like the hidden automatic cameras by which wild animals are made to take their own pictures. Installed on the power line, it keeps watch for hours without attention. Any sort of lightning, from the smallest spark to a 100 million volt flash a half mile long leaves an exact record of its performance with the Norinder instrument. The device measures the rate of rise of the voltage surge, the maximum voltage attained, the duration of the charge and the rate of decrease. It is so sensitive that it records surges which have an ephemeral life of only a ten-millionth of a second—the time taken for a high-powered rifle bullet to travel the thickness of two hairs.

To Test New Instruments

No mechanical device could be made to act so quickly so the moving parts consist of a beam of cathode rays, which are bent here and there by electric attraction to leave their mark on a photographic device. The entire apparatus is in a vacuum.

The klydonographs will record the maximum shock received by the transmission line and thus supplement the oscillograph records. Osisos will function as a part of distance finders to tell the operators how far distant from the power line

(*Please turn to page 275*)

Foreign Trade Developments Affect Wire Industries

British manufacturers face difficulties. New cable and wire rope standards. German metals amalgamation. Aluminum promoted to replace copper

British Cable Specifications

THE substantial variations in the prices of cables according to the source of supply make it important that the cable user should have reliable tests at his disposal, and in this connection the first British Government Department Electrical Specification, which has just been issued, will prove of value. It deals with electrical cables J, K, and L and is used for Government specifications both for supplies and installation work. It contains tests, many of them simple, which the practical engineer can easily apply to any cables.

Interesting tests on the "tinning" of each strand are given, with a view to ensuring the use of high-quality materials. Samples are to be dipped in baths of hydrochloric acid and sodium sulphide alternately several times without visible blackening. The specific gravities of the solutions are given, and the tests could easily be performed in a small laboratory. The proportion of rubber in the total weight of the dielectric is not to be less than 45 per cent, while restrictions in the amount of sulphur and organic matter are of interest to the analyst. Then follow the mechanical tests on the dielectric, which merit fuller description. The stretching of a sample of the rubber insulation of a cable is a favorable way of judging its quality, but how many know exactly what tension to exert and what length of time to maintain it? The Government specification gives the mechanical tests as follows:—

(a) A piece of the dielectric from which the conductor and the outer covering have been removed shall be marked with lines two inches apart and shall then be gradually stretched until the lines are six inches apart. It shall be maintained stretched for a period of 24 hours at ordinary temperature . . . . . At the end of this period the rubber shall show no signs of cracking, and the elongation between the lines shall be uniform in every part. The distance between the lines six hours after release shall not be greater than 2½ inches.

(b) The tensile strength of the complete dielectric shall not be less than 800 lbs. per square inch of the original cross-sectional area of the dielectric test piece.

Heat tests represent another definite attempt to ensure perfection in the insulation and a capability of withstanding exceptional conditions. Using a similar piece of insulation to that in the mechanical test, a dry heat of 270 degrees F. (132.2 degrees C.) is maintained for one hour, and a moist heat of 320 degrees F. (160 degrees C.) for three hours. Three days after heating the samples are to be stretched from two inches to five inches for 24 hours, the distance between the lines six hours after release to be not greater than 2½ inches.

These tests are the results of very careful Government departmental research, and those to be carried out on the insulation of the cable are especially severe.

New Wire Rope Standards

A new standard engineering specification has just been issued by the British Engineering Standards Association for round strand steel wire ropes for use with cage or platform hoists and passenger or freight elevators working in guides, but not with coal hoists and similar appliances. This specification is intended to provide for wire ropes having six round strands of either 12, 19, or 24 wires per strand and of both ordinary and Lang's lay. Recommendations for the guidance of designers and users are made in a foreword, and will, it is hoped, be of considerable value and ensure reasonable endurance in service of wire ropes of the types and kind covered by the specification. Specification for wire ropes for oil wells and for colliery haulage are now in course of preparation by the Association.

British Wire Trade Suffers

A REGIONAL survey connected with every branch of British trade is being published in serial form by the Times Trade Supplement, which says: The iron and steel wire industry, largely centered on Warrington, has been passing through a very difficult period and is still in a depressed state. Imports of foreign wire have risen from 92,863 tons in 1923 to 136,251 tons in 1927. British production in 1927 was 289,000 tons (rather less than half being made in the Warrington and Manchester district), so that imports last year amounted to almost half as much as the total British output.

The industry has made several attempts to secure protection under the Safeguarding procedure. In 1925 it made an application as a section of the iron and steel trade and it is now very dissatisfied because by doing so it seems to have definitely committed itself to a permanent association with the general iron and steel industry so far as the Board of Trade is concerned. In May last the President of the Board of Trade replied to a further and independent application of the wire industry to the effect that the Government had again given careful consid-

eration to the matter, but were of opinion that the same considerations which debarred them from referring it to a committee in 1925 applied to sectional appliances and consequently were unable to accede to the present application.

Six manufacturers have gone out of business during the past year and the outlook is very unpromising. Except for Australia, most of the export business has been lost, but if the industry could be assured of the home market it would be in a much better position to compete for export trade. It is faced with competition from countries whose wage scales have no relation to that in force in this country. Here skilled workers receive £4.5s ($21.25 a week and unskilled men £2.5s ($11.25). In Germany skilled workers receive £2.2s ($10.50), in France £1.18s ($9.50), and in Belgium £1.3s 6d ($5.85). It is not surprising that 50 per cent of the British iron and steel wire making machinery is out of action at present, and that the industry which normally employs about 30,000 men is now finding work for not more than 14,000.

India Revises Wire Tariff

AN act of the British Indian Legislature, effective April 1, 1928, provides for a specific import duty of 2 rupees per hundredweight on iron or steel bolts and nuts, including hookbolts and nuts for roofing, in place of the former import duty of 10 per cent ad valorem, and also provides for an import duty of 10 per cent ad valorem on iron or steel wire nails, including French nails, in place of the former protective import duty of 3 rupees per hundredweight.

The protective import duty of 60 rupees per ton formerly levied on iron or steel wire, other than barbed or stranded fencing wire, wire rope, and wire netting is removed and all iron or steel wire, excluding wire netting, is made subject to an import duty of 10 per cent ad valorem. Wire netting remains subject to an import duty of 15 per cent ad valorem.

British Market Opens For American Electrical Goods

THE super-power system to be developed in the British Isles as the result of recent legislation should present a wide market for American electrical apparatus, it was stated in trade advices from the Assistant American Commercial Attache at London.

The new law contemplates the linking of all stations into one huge electrical system which will provide current to both industry and the home at greatly reduced rates. Naturally, all manufacturers of electrical apparatus will benefit under the new program. Heavy apparatus, cables, wires, etc., are practically controlled by the British industry; the German and Continental makers sell a variety of supplies and special products on a price basis or because of some special features in design.

It is in the expensive high-class type of electrical goods that American manufacturers are prominent, and it is in this field that Mr. Butler believes that future expansion of our electrical trade with Great Britain will occur.

It is only natural to expect, the report states, that the introduction of new American lines will be folowed by strenuous domestic competition. In some branches it has been found desirable to exercise patent rights which might otherwise lapse, to establish associate British plants for the domestic production of American specialties in whole or in part.

Some American exporters have contented themselves simply with royalties on patents placed at the disposal of British makers. In spite of these various arrangements, which cover many important sections of electrical production, and increased European competition, American-made products of various descriptions, such as electric irons, vacuum cleaners, self-contained lighting sets, portable electric tools, etc., continue to sell to British buyers in larger quantities annually.

The capital invested in the entire electrical industry of Great Britain, including generating station equipment, amounts to approximately $4,000,000,000, of which $375,000,000 represents investments in the manufacture of various electrical products.

German Metals Amalgamate

THE Metallgesellschaft and the Metallbank, two important German concerns engaged on a large scale in industry and trade in nonferrous metals with important connections with the chemical industry, have decided to effect a fusion.

The merger will be on the basis of 750 marks par of Metallgesellschaft shares being equal to 1,000 marks par of Metallbank shares. On this basis, the Metallbank will have to raise its capital stock by 25,000,000 marks to make it equal to that of the Metallgesellschaft. The merged company will bear the name of Metallgesellschaft.

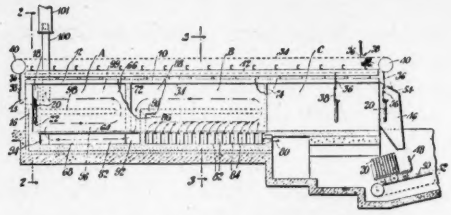
The two companies maintained an informal agreement whereby the Metallgesellschaft was to engage exclusively in trade, and the Metallbank in industry but this division could not be strictly adhered to as trading profits in metals are reported to be meager under present conditions. The Metallgesellschaft accordingly extended its interests to include metal manufacture as well, until the activities of the two compainies became more or less similar. Apparently it is not intended to preserve the two organizations intact after fusion but to concentrate management in one organization, by which plan it is expected to attain greater efficiency and curtail expenses.

Czechoslovakia's Cableway

THE first aerial cableway for passenger transportation in Czechoslovakia is now under construction. It will be 3 kilometers long, with a maximum elevation of nearly 700 meters, and will connect the resort of Janske Lazne (Johannisbad) with the mountain ridge of the Krkonose (Giant Mountains). Aerial cableways in Czechoslo-

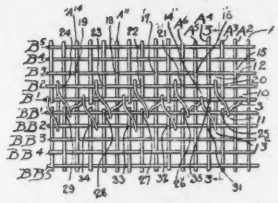
(*Please turn to page 282*)

A REVIEW OF RECENT PATENTS



Wire Annealing Furnace 1,674,407

Detailed technical descriptions are given only for the devices illustrated. All other descriptions of patents listed on this page have been abstracted from official records.



Seam for Woven Wire Belts 1,674,289

1,674,407. WIRE-ANNEALING FURNACE. Forrest W. Manker, Jackson Heights, N. Y., assignor to Surface Combustion Company, New York, N. Y. The combination with a furnace provided with an overhead conveyer adapted to convey wire coils in suspended position through the furnace, of means for loading the coils on the conveyor comprising coil-carrying means movable through the side of the furnace and disposable in coil-transferring relation to the conveyer.

1,674,289. SEAM FOR WOVEN-WIRE BELTS. Hamilton Lindsay, Cleveland Ohio, assignor to The Lindsay Wire Weaving Company, Cleveland, Ohio. A seam for woven wire fabric comprising a single seam-forming wire which extends back into the fabric alternately over different woof wires, and which passes through every third opening across the width of the fabric.

1,672,947. FARM FENCE. Lawrence Lefforge, Wabash, Ind. 1. In a fence, a series of posts, a plurality of arms for each post, a bolt for each post passing through the post and its group of arms, a member between the volt and arms having out-of-round sides which fit in correspondingly shaped openings in the arms, means to keep the last member from rotating on the bolt, means on the bolt to clamp the arms together and wires extending longitudinally of the fence supported by the arms. 2. In a farm fence, a series of posts set in the ground, a plurality of arms for each post, a bolt for each post passing through the post and its group of arms and projecting past the arms, a member between the bolt and arms having polygonal sides fitting in correspondingly shaped openings in the arms and having a curved end conforming to and contacting the post means comprising a nut on the projecting end of the bolt to clamp the members together, and wires supported by the arms and extending longitudinally of the fence.

1,673,125. HAY BALER. John E. Robbins, Greensburg, Ind. In a knotter for baling machines, the combination with a relatively stationary member having a throat across which the wire to be knotted is adapted to lie, of means for engaging said wire and drawing the same into the throat to form a loop and means revoluble about said loop engaging one end of the wire and wrapping the same about the loop so formed.

1,673,185. SPRING - COILING MACHINE. Lloyd E. Des Combes, Springfield, Ohio, assignor to International Harvester Company, a Corporation of New Jersey. In a spring coiling machine, the combination of a frame, a pair of rotatable parallel shafts journaled in the frame, and means on the shaft for forming a plurality of opposed coils in a spring member having a pair of extended legs arranged in spaced parallel relation.

1,673,196. INSULATED-WIRE-STRIPPING DEVICE. Lawrence Johnson and Alfred N. Wentink, Chicago, Ill. In a device of the kind described and in combination, a base having a recess in the bottom thereof, a pair of vertically disposed posts rotatably journaled in the base, means disposed in said recess for constraining said posts to rotate in unison, and knives carried by the posts.

1,673,527. RING SPLICE FOR WOVEN-WIRE FABRICS. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Company, Hartford, Conn. A unit for joining sections of woven-wire fabric composed of intermeshing helical wires of opposite twist, which comprises two helical wires of opposite twist and closed ring connectors joining said wires.

1,673,887. STRAND - REELING APPARATUS. John Nilsen Selvig, Chicago, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y. In a strand reeling apparatus, a take-up spool, a member for distributing material upon said take-up spool, a face cam for positively reciprocating said member alternately in opposite directions, and resilient means for holding the cam in operative engagement with the member.

1,673,922. ADJUSTABLE CLAMP FOR CABLES AND THE LIKE. Harold W. Shonnard, Montclair, N. J., assignor to Elevator Supplies Company a Corporation of New Jersey. In combination with a continuous normally unbent cable, an adjustable clamp comprising a hollow socket having a slot just wide enough to admit the unbent cable and having a chamfered end, and a hollow plug adapted to screw over said end whereby to cause a bend in the cable when the plug and socket are combined.

1,674,156. PROCESS FOR THE MANUFACTURE OF ELECTRIC WIRES. Harry B. Burley, Brookline, Mass., assignor to Boston Insulated Wire & Cable Company, a Corporation of Massachusetts. The method of manufacturing insulated electric wires or cables which comprises the steps of applying a layer of rubber compound to the conductor, applying a layer of fibrous material, semi-vulcanizing said layer, applying a second layer of rubber compound, and vulcanizing the rubber under pressure between heated plates.

1,674,527. TENSION DEVICE FOR COILING MACHINES. Richard Shepherd, Eindhoven, Netherlands, assignor to General Electric Company. In a wire coiling machine the combination of a winding head comprising a rotatable tubular shaft having near one end a wire guide eccentric to and rotatable with said shaft, means for feeding a mandrel longitudinally through said head to have a wire coiled on it, and a spool holder mounted on said shaft adjacent said guide to rotate freely on said shaft and to overrun said shaft as the wire on said holder is drawn off the holder and through said guide during rotation of said shaft, said holder being shaped to have its rotation retarded by the air sufficiently to maintain a pre-determined tension on the wire as it is drawn off the holder.

1,674,548. MEANS FOR CONTROLLING SPRING RESISTANCE. Albert F. Hegenberger and George P. Luckey, Dayton, Ohio. In combination with a spring, means for controlling the resistance of said spring comprising a pivoted element to which said spring is attached, and a counter spring also attached to said pivoted element and arranged to act with progressively increasing force in opposition to the progressively increasing resistance of the first named spring.

NEWS OF THE INDUSTRY

Government to Survey Industrial Equipment

THE Department of Commerce, at the request of interested manufacturers, it was announced July 14, will undertake immediately a survey of industrial equipment in the United States. An important phase of the study, it was stated, will be the determination of the amount of obsolete equipment and its importance as a factor in the inability of certain firms to compete on an equally profitable basis with those having more modern equipment.

Replacement of machinery which in point of service may have many years of usefulness but which in point of satisfying the latest fancies of the consumer market is obsolete, is an important matter for the manufacturer and one which is behind the request for the survey to be made by the Department. Obsolescence merits a definite understanding, especially that it may not be confused with depreciation. The obsolescence of factory equipment is effected largely by style changes or by new product of inventive genius, and not by wear and tear which are factors in depreciation.

New Source of Copper

Tests conducted by the Bureau of Mines, Department of Commerce, in cooperation with the Michigan College of Mines and Technology have demonstrated, according to a statement by the Bureau, that by the use of the "flotation process" the recovery of copper from amygdaloid ores in the Michigan copper mines district can be greatly increased, thus adding extensively to the prospective mineral output of the district. At present, the ores are milled by straight gravity concentration methods. With an average additional recovery of two pounds of copper per ton by the flotation method the district would yield, without additional grinding, 3,240,000 pounds of copper a year. If the daily tonnage of amygdaloid ore be crushed to flotation-feed size, flotation would give an additional recovery of roughly 10,800,000 pounds of copper per year over present practice.

Tungsten Investigation On

The investigation of tungsten now being conducted by the United States Tariff Commission will have to do with that metal as described in paragraphs 303 and 305 of the tariff act of 1922, and will include tungsten contained in tungsten ore or concentrates, and in ferrotungsten, metallic tungsten, tungsten powder, tungstic acid, and all other tungsten compounds and alloys, and in steel containing tungsten, being wholly or in part the growth or product of the United States, and of or with respect to like or similar articles wholly or in part the growth or product of competing foreign countries.

Foreign Trade Opportunities

Foreign trade opportunities reported by the U. S. Bureau of Foreign and Domestic Commerce during the month of July include inquiries from the following sources: For household electrical appliances (32172) from Hamburg, Germany; for household electrical appliances from Santo Domingo, Dominican Republic (32224); for wire box strapping machines from Hamburg, Germany (32213); electrical industrial apparatus (32-324) from Zurich, Switzerland; industrial machinery (32324) from Zurich, Switzerland;, household electric appliances from Cairo, Egypt (32452); rubber covered and cotton covered wire; from Calcutta, India (32563); bare and insulated copper wire and cables from Belgrade, Yugoslavia (32444 and 32548); wire nails from Calcutta, India (32509); nail making machine from Haifa, Palestine (32526);

REPRESENTATIVE WANTED

A prominent Eastern manufacturer wishes to get in touch with a representative now covering wire mills in the middle west. State qualifications and experience. Address: Wire & Wire Products, Box 10.

Aluminum Cartel Welcomes Price Cuts

The full text of the statement about the Aluminum Cartel by the Department of Commerce, made public July 12 and referred to in an article elsewhere in this issue on foreign trade developments, follows:

The price action of the cartel coincided with the action of the International Copper Cartel effecting another advance in copper prices. Germany's interest in eliminating copper from its chief industrial applications for the sake of national self-sufficiency gives significance to the contrast in the price behavior of the two metals.

It was expected that the price reduction on aluminum would affect only wire bars. It appears however to concern H-bars and blocks, while the only advantage gained by wire bars in competition with copper is in the advance of copper prices. The interest in electrical applications of aluminum is more pronounced in Germany than in other European countries. The latter are perhaps more interested in aluminum's chances to compete with steel and brass, especially in the form of aluminum alloys on which extensive research and experiments are being conducted in all aluminum producing countries.

The statement that the European cartel would welcome

another price cut on the part of American producers is not without reservations, as it is stated that an immediate cut would not be desirable. Any sudden action with respect to prices might prove embarrassing at present to certain European countries whose output exceeds the domestic consumption to an extent making it imperative to preserve export markets. Germany appears to be in a position to view any such developments without apprehension since its own domestic market takes care of the entire domestic production. Concern is expressed on behalf of France, whose aluminum exports to the United States are of some importance. It is feared that the high import duty and cost of transportation might easily counterbalance such uncertain advantages as the lower prices of the French product, even though the American prices may never go so low as the European.

Museum for Iron Exhibit

Exhibits portraying manufacture of iron in the early days of the industry will be collected and displayed at the Windsor Forge property, near Churchtown, Lancaster County, Pa., under present plans of the Pennsylvania Historical Commission. The commission, because of the importance of the iron industry and its present position, is eager that the museum be so equipped that it will become an objective of historical pilgrimages.

Building and Expansion

L. A. Young Spring & Wire Company report a record business for the first half of 1928, an increase of 22 per cent. over the same period last year. Net profit before Federal taxes was $1,208,908, equal after estimated taxes to $3.80 a share on the common stock.

Brown Instrument Co., Philadelphia, manufacturers of pyrometers, thermometers, etc., for heat treating control, is building and equipping a new factory addition to be used as a research laboratory.

COMING EVENTS

August 27-30. American Society of Mechanical Engineers Summer Meeting at St. Paul and Minneapolis. Secretary, St. Paul Hotel.

Sept. 10-15. National Association of Power Engineers at Detroit. Secretary, F. W. Raven, 417 South Dearborn St., Chicago.

Sept. 24-28. American Electric Railway Association at Cleveland. Secretary, J. W. Welsh, 292 Madison Avenue, N. Y. City.

Sept. 25-28. Traveling Engineers' Association at Chicago. Secretary, W. O. Thompson, 1177 East 98th St., Cleveland, Ohio.

Sept. 26-29. Railway Equipment Manufacturers' Association at Chicago. Secretary, F. W. Venton, 836 South Michigan Ave., Chicago.

Oct. 1-5. National Safety Council, National Congress, at New York. W. H. Cameron, Managing Director, 108 East Ohio St., Chicago.

Oct. 2-5. National Association Ornamental Iron and Bronze Manufacturers at Boston. Secretary, C. F. Waltz, 622 Broadway, Cincinnati, Ohio.

Oct. 8-12. American Society for Steel Treating at Commercial Museum, Philadelphia, Secretary, W. H. Eisenman, 7016 Euclid Avenue, Cleveland, Ohio.

Oct. 16-18. American Railway Bridge and Building Association at Boston. Secretary, C. A. Lichty, 310 N. Waller Avenue, Chicago.

Oct. 17-19. Society of Industrial Engineers at Rochester, N. Y. Secretary, 608 South Dearborn St., Chicago.

Oct. 17-27. Electrical and Industrial Exposition at New York. Secretary, Lincoln Bancroft, 124 W. 42d St., New York City.

Oct. 23-25. Bridge and Building Supply Men's Association at Boston. Secretary, W. D. Waugh, 322 South Michigan Ave., Chicago.

Oct. 23-26. International Association Municipal Electricians at New Orleans. Secretary H. N. Lang, Box 1864, Orlando, Florida.

Ernest C. Wilcox, president of the Connecticut Telephone & Electric Company of Meriden, Conn., which is now being operated by receivers, has organized a new company known as the E. C. Wilcox Corporation and will manufacture electrical supplies and develop processes pertaining to the electrical business.

Froiland Chain & Mfg. Co., Springfield, Mass., will build and equip a new one-story plant.

Superior Screw & Bolt Co., E. 93d Street, Cleveland, Ohio, will build and equip a new one-story plant at a cost estimated at $75,000.

The MacWhyte Company, Kenosha, Wisconsin, specializing in the manufacture of airplane wire, is erecting an addition to its plant.

Federal Screw Works, Inc., Detroit, Mich., will build and equip a one-story addition at an estimated cost of $60,000.

Ornamental Iron Works, Mt. Carmel, Penna., has been recently organized and will build and equip a one-story plant.

Winsted Insulated Wire Co., Winsted, Conn., is installing a new machine shop to provide equipment for filling a recent surplus of orders that has kept the plant running overtime.

The Atlantic Insulated Wire & Cable Co., Rome, New York, has been recently incorporated to make wire and cable for electric service. The organizers include Herbert T. Dyett, Harry W. Barnard, and C. R. Keeny.

Jackson Screw Products Co., Jackson, Michigan, will rebuild the portion of its plant destroyed by fire a few weeks ago.

Chandeyson Electric Co., 4092 Bingham Ave., St. Louis, Missouri, manufacturers of electrical equipment, will build and equip a new one-story plant.

Marconi Mfg. Co., manufacturers of radio supplies, Seattle, Washington, will erect and equip a new factory at an estimated expense of $55,000.

The Bennett Wire Company, Norwalk, Conn., has filed schedules of involuntary bankruptcy showing liabilities of $23,693.12 and assets of $16,356.91.

Sleeper & Hartley
TRADE MARK

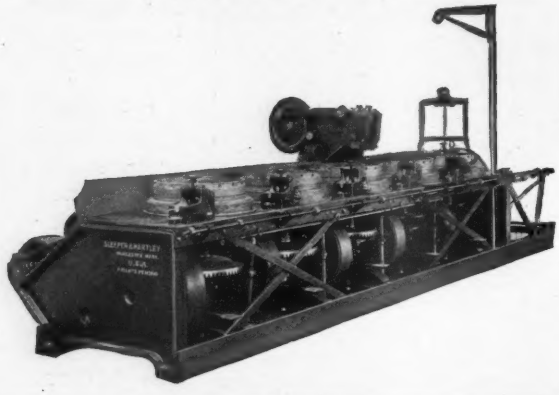
Practical Continuous Wire

These Machines Go Into Production at (...—Ro...

Rod Frame

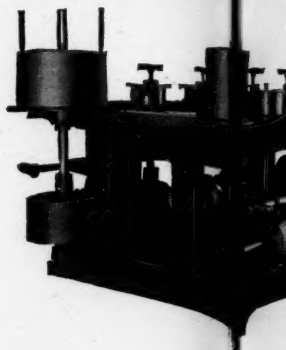
(No. 5—14 or 15 wire)
Patented June 3, 1924—May 12, 1925—others pending

All Ball or Roller Bearings
No Differential Gearing.
Automatic Compensation for Speeds of Heads.

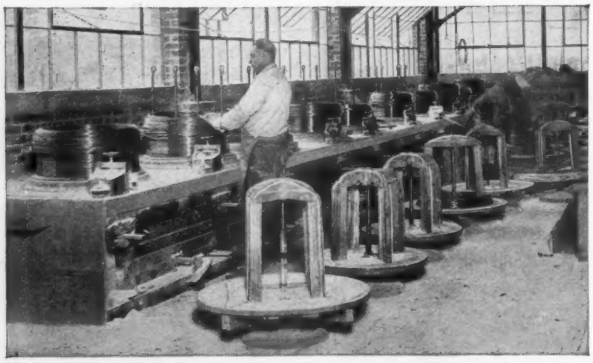


Double 5-Draft...y, ...

No. 14 to No. 23. ...or lo...
3 to 4 Blocks t...erage
No. 14 to 19—4 h...400 l...
No. 14 to 20—5 h...100 l...
More than 270 heads of t...proved

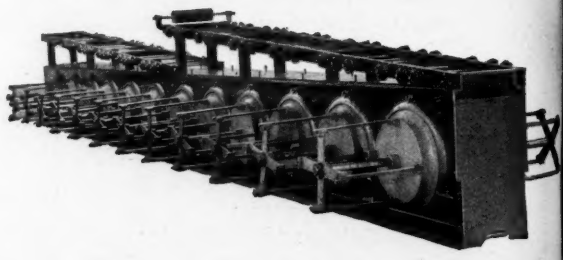


IMPROVED WIRE MILL EQUIP...EN



Standard Rod Frame—10 Block

Long, Stiff Spindles, in anti-friction bearings, and equipped with friction Clutches. Powerful and reliable.
Practically noiseless in operation.
(New Plant of Thompson Wire Co., Worcester, Mass.)



Patenting Furnace Take-Up

(New Plant of Thompson Wire Co., Worcester, Mass.)

Do...

Direct ...friction...
(Ne...

AGENTS: CHICAGO TERRITORY, Neff, Kohlbusch & Bissell, Inc. SAN FRANCISCO AND LOS ANGELES Louis G. Henes

SLEEPER & ...A...

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London, E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels. MONTREAL AND TORONTO—Arthur Jackson Machine Tool Co.

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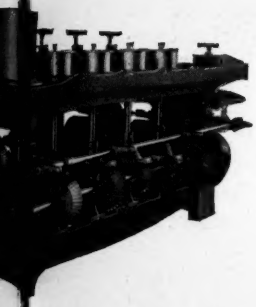
Sleeper & Hartley TRADE MARK

—Reducing Overhead-Increasing Production!!

y, Intermediate

or low carbon wire.
erage Operator.
400 lbs. per block.
100 lbs. per block.
proved model in operation

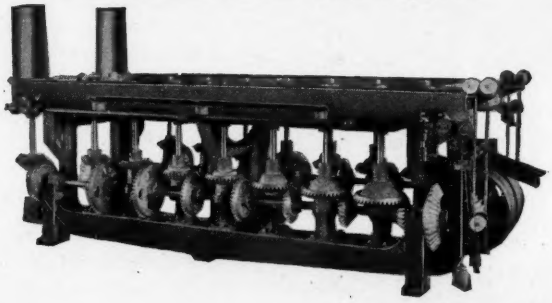


Double 8-Draft Fine Wire: Wet

No. 22 to 36. High or low carbon wire.

6 Blocks to Average Operator, 22-33, 8-hole, 660 lbs. per day of ten hours.

Many thousands of these heads in operation



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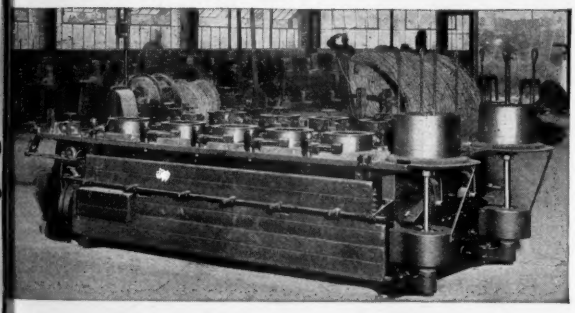
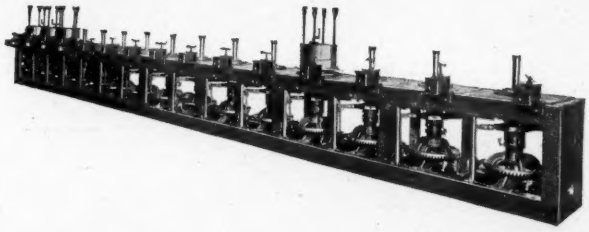


Double Six—Draft Dry Continuous For High Carbon Wire

Direct driven with silent chain. Cut gears throughout. Anti-friction bearings. Variable speed for finishing block.

(New Plant of Thompson Wire Co., Worcester, Mass.)



Heavy 16" Frame For .65 Carbon Wire No. 10½ to .037"

15 Blocks: Motor driven. Silent chain. Anti friction bearings and cut gears throughout.

(New Plant of Johnson Steel & Wire Co., Worcester, Mass.)

ARTLEY, Inc.

Agents: Philadelphia Territory
Swind Machinery Co.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Toyko. SWEDEN AND FINLAND—Maskinaktiebolaget Karlebo, Stockholm.

ASS., U. S. A.

Editorial By-Products

Copper Nails Survive 5,000 Years

CHARIOT wheels excavated on the site of the ancient Sumerian city of Kish in Mesopotamia still have their Copper nails after 5,000 years, according to a recent announcement of the Chicago Field Museum of Natural History.

While the wheels were naturally in a crumbling state, the central portions were practically intact. They are bound with a rim two inches deep studded with copper nails, still in place at intervals upon the rolling surface. Near the wheels were found two pieces of Copper, all that was left of what evidently had been a harness to keep the driving reins in place.

The wheels are estimated to belong to the period between 3200 and 3000 B. C. They were discovered forty-five feet beneath the ground by the joint expedition of the Field Museum and Oxford University. The nails must therefore have been exposed to the dampness of the earth for approximately fifty centuries.

Archaeologists of the expedition believe these two wheels to be the oldest ever excavated.

Device for Handling High-Voltage Wire

A DEVICE for handling of high-voltage wires with safety has been perfected by Arthur Ohlsen, a member of the San Francisco Fire Department. By means of this device, a person can remove highly-charged wires from the body of one who has been shocked or, by means of a quickly detachable life-hook, can pull the body away from a highly charged wire without danger to the rescuer.

In the construction of the tong, according to The Scientific American, well-seasoned white eastern maple is used. This is impregnated with paraffin to remove all moisture, sap and acid, thereby rendering it a perfect non-conductor. The device has been tested to 225,000 volts without any leakage.

The tong is about five feet, eight inches in length, and has a bakelite grip at one end while at the other end are fingers which grip the wire to be handled. These fingers pass up through the maple pole and are attached to a bakelite grip near the center of the tong. By pushing this grip along the handle the two fingers are opened so that they can be used in grasping the charged wire. When the wire has ben grasped properly, the center grip is moved along the handle until the fingers are tightened on the wire. Then the operator can handle the charged wire with ease and safety.

Lightning Rods Protect Oil Reservoirs

TWO-HUNDRED four lightning rods, with grounded wire networks, have been adopted by three Pacific Coast oil companies to protect their oil reservoirs following fires started by lightning that have caused losses of millions of dollars. The towers protect against direct strikes, while the network is designed to carry off any induced charge, keeping it off the reservoir and providing a good metallic path for its passage to the ground.

Wire Nets Scare Away Birds

A novel use of wire is reported from San Francisco, where sea gulls began about ten years ago to form the habit of leaving the water front and flying inland far enough to infest the city reservoirs of the Spring Valley Water Company. Attempts to scare them away were of no avail and eventually the company had to roof those reservoirs where covering was feasible. Some of the reservoirs could not be covered economically, chiefly because of their size and depth, and in those cases attempts were made to drive the birds away by shooting.

Later, according to Engineering News-Record, it was found that the seagulls would not pass through a network of wires 40 to 50 ft. apart each way. Practically all of the reservoirs of the Spring Valley Water Company located near salt water have been so protected, including a reservoir 1,000 ft. long and 600 ft. wide. Even in this large area the wire network has thus far been successful.

For the smaller reservoirs, No. 9 galvanized-iron wire was used fastened to 2-in. pipe supports driven into the ground; where the spans were so long that wires of this size would not be strong enough to withstand the necessary strain, wire cables of ¼-in. to½-in. diameter were strung first to support the smaller wires. The wires are pulled taut enough to keep the low point on the curve about 1 ft. above high-water level in the reservoir. On some of the longest spans, pipes resting on the bottom of the reservoir and extending up to the desired heights were used to provide intermediate supports and prevent too much sagging.

DIGEST OF RECENT TRADE LITERATURE

The Copper Cartel. Harvard Business Review, April, 1928, P. 322.

How the copper industry has accomplished the feat of re-establishing pre-war profit margins from a pre-war market price and a post-war material and labor cost. The chief outstanding example of American participation in an international cartel is hampered by American laws and is deprived of the cartel's major weapon—control of production. Some of the problems that confront the copper interests include: effective price control, in turn involving control of production; the lower the output the higher the unit cost; the legal dangers of price control; substitution of other metals, particularly aluminum; fundamental divergence of interests between:

a. High and low cost producers
b. Custom smelters and miners
c. Rivalry for industrial leadership
d. Antagonism abroad
e. The foreign dealer

The Banker and the Industrial Engineer. The Society of Industrial Engineers Bulletin, April, 1928, P. 5.

A number of letters were sent to investment bankers requesting information concerning the use and value to them of engineers' reports on business and management in connection with engineering services in management reorganization, financing, and manufacturing and marketing problems. Replies indicate that really broad industrial engineering is not well understood and that it is doubtful if investment bankers have a true appreciation of the problems of industrial management or the risks of industry. Greater appreciation of the recognition which their services warrant is predicted if engineers adhere to sound ethics and maintain the same high standards for their own services that they recommend to their clients.

Who Buys Equipment in Manufacturing Plants? Manufacturing Industries, April, 1928, P. 279.

An analysis of a survey that covered 91 large companies shows that those responsible for the purchasing include 23% managers, 19% superintendents, 19% engineers, 12% major executives, and 27% with a wider designation of title.

An Index of the Installation of Machinery in the United States Since 1850. Harvard Business Review, April, 1928, P. 278.

Business growth is traced over the period indicated and a novel growth unit is introduced in the form of an analysis of horsepower per employee. As man's work is being more and more increasingly performed by machines, the amount of mechanical equipment per inhabitant likewise increases steadily. The index of horespower equipment per employee is preliminary to ascertaining an index of amount of production per employee, so as to establish a relationship.

Trade Literature Received

Screens

"Getting Results With Ludlow-Saylor Screens". The Ludlow-Saylor Wire Co., Saint Louis, Mo. 190-page bound book, profusely illustrated. A very comprehensive manual for the purchaser and user of crimped wire cloth, special wire cloth, and woven screens in standard and special metals. Diagrams and photographs graphically present actual industrial installations and the data tables are unusually complete.

Testing Machines

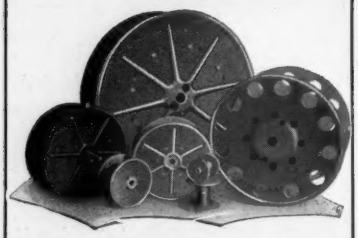
"Wire and Coil Data". Dudlo Manufacturing Corporation, Fort Wayne, Indiana. Pocket-size folder giving sizes of bare wire on B & S Gauge, diameters in inches and milimetres, and the equivalent sizes in enamelled wire. There are tables for covered wire weights, ohms per 1000 feet, and ohms per pound. The winding data includes turns per square inch, ohms per cubic inch, and a method for determining actual winding space.

Covered Wire

"Evolution of the Testing Machine". Riehle Bros. Testing Machine Co., Philadelphia, Pa. 16-page booklet tracing the history of American testing machines since 1866. In that year the first Riehle testing machine was built to test cast iron pipe in connection with an important law suit. Since then machines have been built for nearly every conceivable testing purpose, including not only metals but such dissimilar materials as golf balls, textiles, bones and button holes.

Metallography

"Micro-Metallographic Equipment". E. Leitz, Inc., 60 East 10th St., New York City. 32 pages, with supplementary bulletins. Describes, with illustrations from photographs, the company's apparatus for studying the micro-structure of metals as they pass through thermal and mechanical treatments at various stages of manufacture. Equipment includes microscopes and cameras, objectives and oculars, specimen holders, and apparatus for specimen measuring, grinding, polishing, and etching.



Light and Durable

Pressed Steel Reels

APCO - MOSSBERG Pressed Steel Reels for annealing and stranding are recognized throughout the wire industry as real money savers.

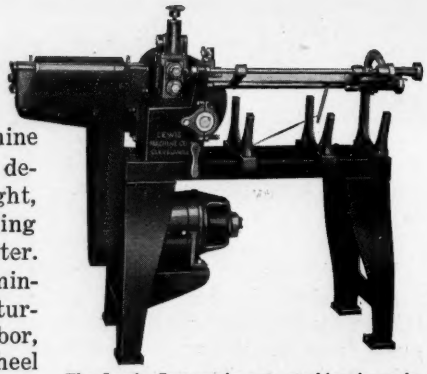
Modernize your equipment by using these light and durable reels made by a company thoroughly versed in pressed steel work.

Apco Mossberg Corporation

13 Lamb St., Attleboro, Mass.

Specialists in Developing Steel Reels for Annealing, Vulcanizing and Stranding; Also Bobbins for Wire Handling.

New Straightening and Cutting Machine



The Lewis Company's new machine is equipped throughout with tapered roller bearings.

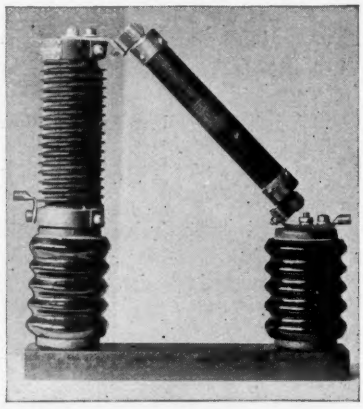
THE Lewis No. 7-C Machine is designed to meet the demand for a medium weight, motor drive machine handling wire up to 3/16 inch diameter. Bulky castings have been eliminated to facilitate manufacturing. The straightener arbor, main drive shaft and flywheel are mounted on Timken tapered roller bearings, making a total of six to each machine. The straightener arbor consists of 5 sets of dies, assuring perfect straightening of all sizes of wire. Either hard iron or bronze dies are used, depending on the finish of the wire to be straightened.

The clutch is similar in construction to a standard punch press clutch. The operating parts consist only of a trip lever and clutch dog, which drive the flywheel shaft. This shaft revolves only when the wire is being cut off. It is mounted on bronze bushings in the bed. The cutter bar is operated by a cam on the flywheel shaft. A ball bearing, mounted in the cutter bar, runs on the cam. The feed rolls are geared directly to the flywheel, the lower feed roll shaft running in bronze bushings in the housing, the upper running in a long sleeve which takes the pressure from the adjusting screw.

An automatic feed roll release lever, operated directly from the cut-off shaft, releases the pressure from the feed rolls when the wire is being cut-off. This is designed to prevent slipping of the feed rolls on the wire during the cut-off operation, to avoid working of the wire and to increase the life of the rolls.

The machine is driven through a double Allis-Chalmers Texrope. This is now considered the best drive available for high speed power transmission, and, due to the necessary high speed of the straightener arbor, is particularly adapted to wire straightening and cutting machines. It eliminates costly high speed gearing and the noise, vibration, and oil housings that go with it. The motor is mounted on a bracket, which is bolted directly to the machine leg, placing the motor under the machine and affording greater protection for it.

New Wire Wound Resistor



THE Westinghouse Electric and Manufacturing Company announces a Type H. combination potential transformer fuse and wire wound resistor for 2500 and 25,000 volt service. It is intended for indoor application and can be mounted on any flat surface or upon 1-¼ inch pipe. The resistors are placed in series with the fuses and effectively limit the current in case of short circuit. This permits the use of potential transformer fuses on any circuit regardless of its short circuit amperes, provided the voltage rating of the system is not more than that of the fuses and resistors.

The resistors are made up of coiled nichrome wire wound in the grooves of a heavy wet-process porcelain tube. They are combined with fuse, fuse mountings and insulators as shown in the accompanying illustration. The resistor may be mounted either in line with or perpendicular to the insulators. This permits the apparatus to be adapted to space requirements.

Engineers Will Make Elaborate Study of Lightning

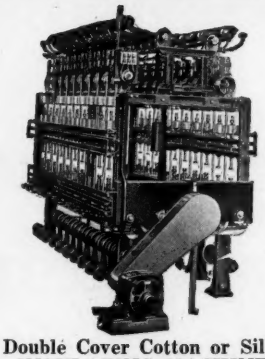
(*Continued from page 264*)

the bolt of lightning flashed. The cameras will record any lightning within their range. All the devices are automatic. For example, oncoming thunder storms will automatically give warning of their approach by ringing a bell, thus enabling the operators at the lightning station to go into action.

With this installation and with a crew of engineers on duty 24 hours each day for an indefinite period, it is expected that data concerning the effect of lightning on high-voltage transmission lines will be recorded in such detail that the development of lightning-proof apparatus will be greatly facilitated.

The visualization of superpower transmission lines of the future, when many power stations and lines will be linked together, is the main motive behind the exhausting gathering of data in Tennessee. Even now electrical engineers are planning for a future in which the mountain stream, perhaps in New York State, will generate electricity for the lights in an Ohio metropolis, when it is economically justifiable. Such a network of power lines will require high-voltage transmission over systems which are failure-proof.

Lightning, to date, has been the unknown quantity that prevented the designing engineer from producing apparatus that would function despite what in legal terminology is spoken of as an "act of God."



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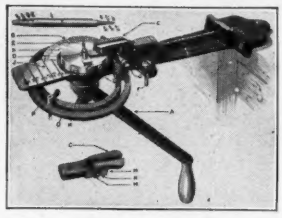
BREGUET HIGH-SPEED
WIRE DRAWING MACHINES

KILMER LITTLE GIANT WIRE FORMER

Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.
Adjustable for No. 8 to No. 24 Gage Wire.
The cut on the left shows a few of the thousands of the forms made on this
FORMER
Price $50.00



Patented April 2, 1918
Cleveland, Ohio, U. S. A.
Box 237, Station B.
M. D. Kilmer & Co.

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Trade Mark of D. H. Co.

Diamond Dies

The perfected "Premier" Diamond Die will draw true to expectations any metal in any size suited to diamond die drawing—and do it with a marked decrease in interrupted production, repair work and replacement costs—that is why we say "Premier Diamond Dies save die expense." Satisfactory service is insured by a reputation backed by over twenty years of quality wire making.

Let us demonstrate their advantages for your particular requirements.

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Alloy Makers since 1899

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WIRE is in a position to give you this information and wants you to use this service which we are glad to extend to our subscribers. The publication is in constant touch with the sources of supply and raw material used in this industry. WIRE has on file, or can get for you, catalogs of all manner of equipment to answer every possible contingency that may arise.

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Further Mechanical Tests of Wire

(*Continued from page 259*)

extends this rounded point serves as a fulcrum for the clip C, and hence a point Q, equally distant on the other side, moves, relatively to B, through a distance equal to twice the extension. This distance is measured by means of a miscroscope attached to B. The miscroscope forms a prolongation of B and the motion of Q is brought into the field of view by means of a hanging rod R. The rod R is free to slide on a guide in B, and carries a mark on which the microscope is sighted.

The displacement is read by means of a micrometer scale in the eye-piece of the microscope. The pieces B and B^1 are jointed to one another in such a way that the bar may twist a little, as it is sometimes liable to do during a test, without affecting the engagement of P with C. This also obviates any need of absolute parallelism in the axes of attachment of the two clips. But the joint between B and B^1 forms a rigid connection so far as angular movement in the plane of the paper is concerned. This feature is essential to the action of the instrument; it is only then that P serves as a fixed fulcrum in the tilting of C by extension on the part of the specimen.

The Technique of Testing

The procedure of the test is to clamp the specimen securely and apply loads to the test piece in a machine in equal increments. It is advisable to know the breaking stress of the specimen beforehand and then to make the increments of load about 1/15 to 1/20 of this amount. During the first two or three loadings the amount of strain on the test piece will vary slightly and this is due to the very slight waviness which may be still in the specimen. On subsequent loading the speci-

(*Continued on page 278*)

Less time for pickling when wire is properly cleaned beforehand

YOU can speed up the pickling operation and assure better work by cleaning wire the Oakite way before it enters the pickling bath. A solution of this remarkable cleaner will remove every trace of oil and grease, soap or compound, and give the acid a chance to act quickly and evenly.

You'll save money, too, by decreasing pollution of the acid—thus cutting down the amount of upkeep necessary to maintain a bath of the correct strength. A good, sharp pickle with less brittle wire will result.

Look into this money saving idea. Call in the Oakite Service Man and ask him about Oakite methods for anti-rusting wire and cleaning before galvanizing. His familiarity with wire production methods will enable him to give you many helpful suggestions. No obligation.

Oakite Service Men, cleaning specialists, are located in all the leading industrial centers of the United States and Canada

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OAKITE

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Industrial Cleaning Materials and Methods

A Pressed Steel Reel for Vulcanizing

ONE of the many Mossberg designs developed especially for the wire manufacturer. The constructional details of this reel place it in a class by itself. While it may be used for other purposes, the free opening through the center makes it particularly desirable for vulcanizing. Extremely strong and rigid, with weight at the minimum.

Arc welding makes each reel practically one continuous piece of steel, with no bolts or rivets to loosen and cause trouble.

Patent No. 1630670

Diameter 36" to 84"

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140 So. Dearborn St., Chicago

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Cabling and Laying up Machines
Complete Equipment for the manufacturing of
Conductor Cable and Wire Rope
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The Waterbury Wire Die Co.

Diamond and Chilled
IRON DIES
DIAMOND TOOLS
Waterbury, Conn.

(*Continued from page 277*)

men will deform elastically and the strain will be proportional to the loading up to a point which is called the Elastic Limit, where the strain increases faster than the load and there is a permanent set.

On further loading with a slight increase in strain each time a point is reached where the specimen yields suddenly and the material behaves plastically. This point is called the Yield Point.

On loading beyond the yield point the material stretches but the strain becomes local rather than general.

Herewith are diagrams showing stress strain curves of a mild steel and a hard drawn wire. It will be noted in the case of the mild steel that the elastic limit and the yield point are well defined, whereas in the case of a hard drawn wire the elastic limit is extremely low and the yield point to all intent and purposes coincides with the breaking load.

Elastic Limit Changes

The Elastic Limit or limit of proportionality is completely altered by wire drawing. Cold drawn wire is, in fact, never perfectly elastic, there being a slight but definite departure from perfect proportionality of stress and strain at very low loads. This is due in all probability to the fact that the crystals are left in a state of internal tension so that very small loads cause yielding of the units which make up the aggregate. It has been shown, however, that the elasticity can be restored by releasing these internal stresses, either by blueing or subjecting the material to alternating compression and tension. This brings it into the stress free condition and so restores more or less the natural elasticity of the steel.

Fortunately this lack of perfect elasticity is not, from the practical point of view, a very serious matter, because the amount of permanent stretch in a wire, even at loads near the breaking load, is for most purposes negligible, and it is now becoming common practice to specify a certain "proof load" or "effective stress" for wire instead of the elastic limit. This is a definite fixed load at which the total extension must not exceed a certain value, usually 0.1 per cent.

As the elongation on a piece of wire varies considerably and there is no fixed standard gauge length, it is usual to have a special machine for taking this elongation.

Figure 2 shows a machine designed by Messrs. W. & T. Avery Ltd. for testing the percentage elongation on a specified length of wire. The machine consists of a cast iron bed, one end of which is machined to receive wedge grips, the other being bored out to receive a gun mettle bush in which the straining screw works. At one end of the straining screw is attached the holder which is machined out to receive grips for holding the specimens and at the other end of the screw is a small hand wheel for quick positioning of holder. The strain is applied through bevel gearing on to the straining screw by means of a hand wheel. A graduated scale is fitted to the bed and a pointer is attached to the holder. The scale is graduated for a 50% elongation and is marked in inches and in percentages.

Torsional Test

The next most common test specified for wire is the torsional test. This test was originally devised when patented steel wire first came on the market Patent steel wire was originally made out of crucible cast steel and later, when the Bessemer steel process came into general use, the cast steel gave place to a high carbon steel made by the newer process. High carbon Bessemer steel unfortunately was not very homogeneous, and the torsional test was devised to show if the metal was of a homogeneous nature or not. If the steel were good

throughout its whole length it would torsion evenly from end to end, but if there was a lack of homogeneity it would torsion in places and jump an inch or so and start to torsion again.

There is not the same necessity for this test as there was when the Bessemer steel was used, as with the Siemans Martin steel a much more uniform product is produced. The test, however, is still used and is now supposed to indicate the quality of the wire, but it is very questionable if the torsioning of a piece of wire indicates the quality of the material.

Torsional Standards

The machine that is generally used is a hand operated machine where the wire is gripped by a stationary vice at one end and by a vice which rotates round the axis of the wire at the other end. The spindle of the rotating vice is free to slide so as to automatically adapt itself to the varying length of the wire while being tested. A counter can be fixed to the machine or the operator can count the number of torsions.

In torsioning wire it is important that an even, steady pressure is applied. If the movement is spasmodic or jerky it is apt to reduce the number of torsions. In a great number of specifications it is laid down that the torsions will be at the rate of 60 per minute. Figure 3 is an illustration of a well designed torsional tester for wire, manufactured by Samuel Denison. This tester tests wire from 3 inches to 17 inches long. A dial counter records automatically the number of twists the wire will stand before breaking, up to 100. The counter has an adjustable finger for setting back to zero again after each test. The loose head containing the fixed vise can be fixed in any desired position according to the length of wire to be twisted, and for this purpose there are two engraved indices, one graduated in inches and fractions, and the other in divisions repre-

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VIANNEY

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The oldest and largest Diamond Die plant in the world.

DIES of every weight for every purpose

100-5th Avenue **New York City**

(*Continued from page 279*)

senting 100 diameters of the various numbers in the Standard Wire Gauge. The reason for the inclusion of the latter scale is that a great number of engineers now specify that the torsions have to be a certain number in 100 diameters length of the wire, and insist upon the wire being torsioned in that length.

Previous to the engineers stipulating this condition, wire used to be torsioned as a rule in 8 inches for all sizes. This gave exactly 100 diameters for a number 14 S. W. G., which is an average diameter of a wire.

A Few Fundamentals in Cost Accounting

(*Continued from page 263*)

known that an estimator cannot anticipate carelessness or unskilfulness in the operators, or know to a certainty that the expected operations predicted by the engineering department will eventuate without change or deviation.

That example illustrates the difficulties encountered in distributing labor. It also shows the effect that a departure from a standard method of procedure has on the overhead rate. Had I used the productive hour as the base for overhead distribution, the result would have been practically the same.

I fully agree that setting up overheads by production centers or sub-departments is slightly if any more expensive than doing the same work by departments. It means a few more sub-totals with no radical change in cost system where departmental overheads are used.

A company may have a press room under one foreman. In this room, no doubt, there is a wide variety of presses for blanking, piercing, forming, etc. We do not advocate a production center for each make or kind of press, but we do believe that experience combined with com-

mon sense will enable one to group these machines into a few classes where the known overhead of each group is similar in its relation center to which direct overheads are charged. Each production center shares the press room general charges. It is an expansion of the departmental overhead idea having a two-fold purpose, to produce more accuracy in cost accounting and to localize sore spots. A bad practice is half cured by its discovery.

As an illustration of the dangers that lurk in the background of a business using one general overhead when it is possible to departmentalize the factory, take the following example.

Danger of General Overhead

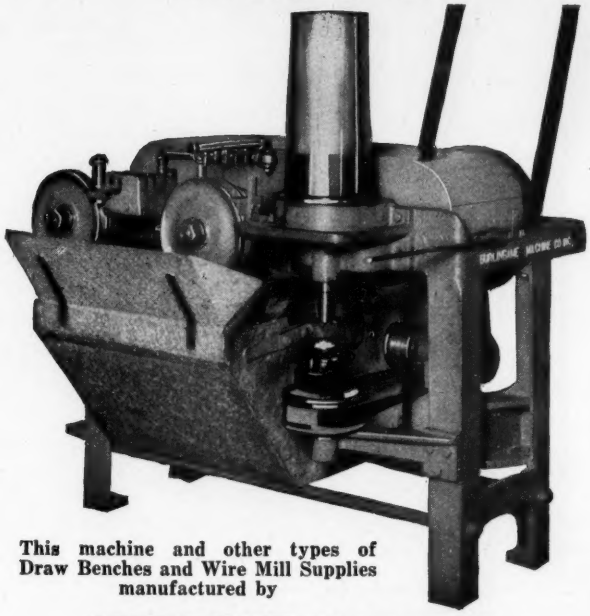
A manufacturer has four departments in his factory. He produces four different articles. His cost system gathers overhead costs into one department and may or may not show the various items of indirect labor, operating supplies, etc., making the total. His direct labor is distributed correctly to the four products made. He finds that at the end of a given period he has spent $25,000 in the operation of his factory, divided in the following manner:

Article No. 1	
Direct Labor	$2,250.00
Article No. 2	
Direct Labor	4,200.00
Article No. 3	
Direct Labor	1,550.00
Article No. 4	
Direct Labor	2,000.00
Total Direct Labor	$10,000.00
Overhead	15,000.00
	$25,000.00

If direct labor is the base for the application of overheads, his overhead rate is 150%. Suppose he uses that rate in calculating his costs. It is the only rate he has, so the supposition is natural. Purposely omitting any consideration of selling and administrative expenses in order to simplify the illustration

(*Continued on page 282*)

Continuous Wire Drawing Machine
6 Draft Liquor Finish
For Drawing Fine Wire



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Above is shown a 24" x 16" x 6" "American" Reel with beaded flange for shop use and shipping. Standard models range from small spools with 2½" diameter to giant reels 8' in diameter, and include Stranding, Vulcanizing, Impregnating, Braiding, Annealing, Shipping and Shop Reels and Spools and Beams for a great variety of industrial purposes.

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Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes
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AMERICAN PRESSED STEEL REELS

and assuming that his selling prices have been so set that a net profit of 10% on his factory costs is expected, he is justified in the belief that he is making progress. He sells in a year's time 1,000,000 pieces of article No. 1, 100,000 pieces of article No. 2, 100,000 pieces of article No. 3 and 500,000 pieces of article No. 4. His expected profits of $9,562.50 are divided among the articles as shown in (A).

When Figures Mislead

He has every reason to believe that he is making money. His figures prove it and "figures do not lie." They lull him into a state of complacency and satisfaction and he thinks of expanding his business and thereby enjoying more profits. But out of the accounting department comes a statement showing that he has lost $1,562.50. He cannot understand it and does not believe it until an inspection of his balance sheet shows him that his assets have dwindled by an amount exactly equalling his loss. He is sore and depressed. He thought he was doing well and finds that he is headed for bankruptcy.

In desperation he hires Jim Carney to solve his problem. Jim analyzes the products by processes of manufacture, breaks down the factory costs into four departments or production centers, and demonstrates the value of practical accounting in that business by presenting a report illuminating but astounding to that manufacturer.

This report shows that Dept. A is equipped with automatic machinery, requiring but a few men in its operation and therefore developing a high overhead rate. Dept. B is equipped with a class of machinery demanding much more labor to operate. Consequently the overhead rate here is lower than in Dept. A. Dept. C has a still lower overhead rate, being a room where sub-assemblies are performed. Dept. D is a final assembly room where the chief expense is labor and has the lowest overhead rate of any of the four departments.

The operating costs of these four departments according to Jim's report are as indicated in (B.)

Article No. 1 passes through Depts. A, B, and C and is a finished article without having to touch Dept. D. Article No. 2 passes through Depts. B, C and D. There is no work required on it in Dept. A. Article No. 3 passes through Depts. A, C and D. It travels from the room with automatic machinery to the assembly rooms. Article No. 4 passes through Depts. A, B and D. It skips the sub-assembly room. Applying the overhead rates developed for each department to the direct labor furnished by each of those same departments on each article, the costs appear as set forth in (C). Instead of a profit of $5,625 on article No. 1, there was a loss of exactly that amount, a difference of $11,250. Article No. 2 more than doubles the expected profit, jumping from $1,050 to $2,225. An expected profit of $387.50 on article No. 3 turns out to be just $200. more than that amount, while article No. 4 can show but 50% of the expected profit.

That man's troubles were due to ignorance of costs, ignorance of the correct method of using underlying and fundamental principles applicable to any line of industry.

Foreign Trade Developments Affect Wire Industries

(*Continued from page 266*)

vakia have hitherto been used exclusively for the transportation of materials in various industrial plants, quarries, forests, etc.

The industrial cableways in use include two types—the so-called single-cable system and the twin-cable system. The single-cable system, with the bucket suspended from a rider gripping an endless cable, is used only for short hauls; the

twin-cable system, with the bucket suspended from a trolley which is pulled along a fixed cable by a second endless cable, is in more common use, particularly for long-distance hauls where economy of operation is especially important.

The carrying capacity of Czechoslovak aerial cableways ranges from 15 to 100 metric tons per hour and the length from 500 meters to 15 kilometers. Supporting frames are of either wood or iron. Motive power, as a rule, is supplied by electric motors or oil engines. The total length of cableways now in operation in Czechoslovakia is estimated at 270 kilometers, with a total carrying capacity of 6,000 metric tons per hour.

Aluminum Price Competition

A CAMPAIGN for a more extensive use of aluminum in the electrical industry in competition with copper, steel and brass, is expected to result from the recent price reduction announced by the European Aluminum Cartel, the American Consul at Frankfort-on-Main, Hamilton C. Claiborne, has informed the Department of Commerce.

The price reduction announced was £10 per ton and reports are current that the cartel would welcome price revision on the part of the American industry,

It is stated that the German production of aluminum is much greater than is generally believed. The popular error that the recent price cut was due to the employment of the more economical Haglund process has been explained by German authorities. It appears that the Haglund process is not yet used to an extent to influence European prices. An experimental plant at Lautawerk is equipped on a comparatively large scale, but the only plant designed to use the process on a commercial basis is now under construction near Venice. There are also experimental plants in several other countries.

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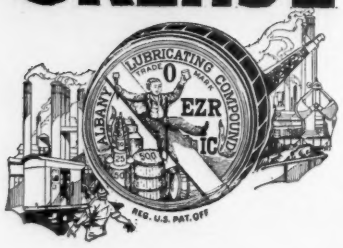

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Domestic Exports of Iron and Steel Wire, Wire Rope and Nails, From the United States, By Countries

May, 1928

Countries	Plain iron or steel wire	Galvanized wire	Barbed wire	Wire rope	Insulated iron or steel wire and cable	Wire nails
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Denmark	100					
France	500					
Germany	466			778		
Greece				2,649		
Italy				29,001	12	243
Norway	3,000					70
Portugal	800			1,130		
Soviet Russia in Europe				38,796	12,946	
Switzerland	1,531					
United Kingdom	30,841	71,201			2,905	29,139
Canada	1,300,799	2,482,117	923,920	58,577	34,601	11,007
B. Honduras			7,500			1,085
Costa Rica	3,000	9,402	39,385	151	42	9,331
Guatemala			132,944	90		51,341
Honduras	307		263,500	3,746	865	42,969
Nicaragua		1,500	143,405	3,688		50,415
Panama			113,450	109,749		11,505
Salvador		422	82,035	512		14,152
Mexico	159,841	284,684	1,780,194	73,199	56,372	54,347
Miquelon & St. Pierre Is.						13,700
Newfoundland & Labrador	112,652					9,500
Bermudas			612		315	2,000
Barbados						1,700
Jamaica		4,205	209,244			1,950
Trinidad & Tobago	8,000	1,268		130		9,900
Other B. W. Indies		4,129	10,050	1,850		8,400
Cuba	24,100	189,024	1,050,625	22,518	2,202	564,405
Dom. Rep.	800	3,000	275,560	3,244	1,120	148,733
Netherland W. Indies			91,500	21,35	284	16,800
Haiti, Rep. of	475	1,239	5,680	615	842	39,700
Virgin Islands of U. S.			8,900			1,300
Java & Madura			143,078	26,935		
Argentina	1,231,377	1,275,941	2,810,655	7,681	3,334	400
Bolivia	98	212		278	232	1,600
Brazil	105,313	82,100	4,584,383	8,490	2,332	325
Chile		1,582		33,876		3,580
Colombia	34,925	5,009	507,400	26,659	10,198	194,203
Ecuador	403			468		
B. Guiana		341		150		
Surinam				100		
Peru	7,898	17,990	105,874	8,319		112,926
Uruguay	200		45,106			400
Venezuela	1,000	124	356,800	30,274	5,949	44,052
B. India				12,410		
B. Malaya	1,225	56,580		37,917		210
China	3,740	169,904		11,440		1,443,643
Other Netherland E. Indies			68,312	28,509		760
Hong Kong						300
Iraq	30,006					
Japan	142,481	359,195	738		93	458,319
Kwantung	4,022					
Philippine Islands	5,495	26,956	246,400	308,772	2,304	698,100
Soviet Russia in Asia			60	326		33,424
Australia	89,458	29,436	56,000	5,260	95	7,405
B. Oceania						1,500
F. Oceania	100	2,160				1,600
N. Zealand	407	80,080	17,920		64	595
B. E. Africa				163		
Union of South Africa	8,76o	56,000	436,125			20
B. W. Africa						300
Egypt				512		
Liberia						1,200
Mozambique					5,556	
Total Quantities	**3,314,126**	**5,215,801**	**14,517,355**	**901,397**	**142,663**	**4,098,548**
Total Value	**142,916**	**146,028**	**415,685**	**120,362**	**25,496**	**310,096**

Shipments from the United States to Non-Contiguous Territories.

Alaska						310,096
Hawaii	10,141	59,357	34,769	38,632	414	154,270
Porto Rico	12,248	49,038	142,870	15,181		166,507

May Wire Exports

ALTHOUGH the May export figures in classifications included in the tabulations at the left in the above Department of Commerce statement show a decrease in tonnage as compared with the April figures, the total value showed an increase of $1,160,583 as compared with $847,936. The total quantities shipped in May amounted to 28,189,890 as against 36,807,980 in April. No similar comparison of the finished wire products listed in the tabulation at the right is possible because of incomplete figures.

The second month in the second quarter shows Canada receiving nearly double the ton-

Domestic Exports of Iron and Steel, Wire Manufacturers, Horseshoe Nails and Horseshoes From the United States, By Countries

May, 1928

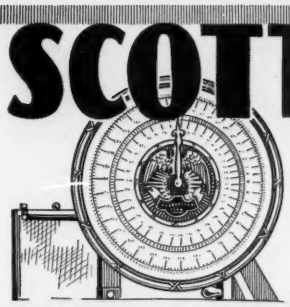
Countries	Woven wire fencing	Woven wire Screen Cloth		Wire n. e. s. & manufactures of	Horseshoe nails	Horseshoes
	Pounds	Pounds	Dollars	Pounds	Pounds	Pounds
Belgium	.....	.....	.....	1,466	7,920	.....
Czechoslovakia	.....	.....	.....	59	.....	.....
Denmark	.....	.....	.....	450	.....	.....
Finland	.....	.....	.....	1,218	.....	.....
France	.....	.....	.....	9,872	.....	.....
Germany	.....	.....	.....	3,462	20,367	.....
Irish F. State	.....	.....	.....	11,797	.....	.....
Italy	.....	.....	.....	600	.....	.....
Latvia	.....	.....	.....	.....	3,520	.....
Netherlands	.....	.....	.....	91	7,556	.....
Norway	.....	.....	.....	927	.....	.....
Portugal	.....	.....	.....	150	.....	.....
Soviet Russia in Europe	.....	1,706	196	94	.....	.....
Spain	.....	.....	.....	1,266	.....	.....
Sweden	.....	.....	.....	1,693	.....	.....
Switzerland	.....	.....	.....	.....	12,980	.....
United King.	346,298	466	143	136,762	.....	.....
Canada	405,111	97,642	18,062	671,346	269	63,985
B. Honduras	2,750	.....	.....	58	.....	300
Costa Rica	868	712	143	337	300	8,600
Guatemala	873	361	57	21	.....	.....
Honduras	7,336	1,814	301	2,723	100	.....
Nicaragua	1,819	1,089	154	897	300	100
Panama	27,745	1,006	116	12,042	100	500
Salvador	.....	1,078	137	701	.....	.....
Mexico	72,322	38,706	5,986	124,291	6,883	6,750
Newfoundland & Labrador	9,767	148	14	1,469	.....	.....
Bermudas	1,084	.....	.....	847	.....	.....
Barbados	.....	.....	.....	2,708	.....	.....
Jamaica	1,708	1,592	247	95	.....	.....
Trinidad & Tobago	6,885	1,911	276	267	.....	.....
Other B. W. Indies	2,206	100	19	974	.....	.....
Cuba	87,78	4,876	624	130,972	15,620	700
Dom. Rep.	4,670	1,386	168	5,519	.....	.....
Netherland W. Indies	95,334	686	170	77,746	.....	.....
Haiti, Rep. of	506	385	73	20,569	.....	.....
Virgin Islands of U. S.	.....	.....	.....	117	100	535
Argentina	70,553	434	408	12,640	.....	.....
Bolivia	16,678	879	291	4,811	.....	.....
Brazil	7,795	13,113	1,730	4,443	4,923	.....
Chile	.....	8,694	1,164	10,174	2,125	1,200
Colombia	44,690	28,356	3,081	58,738	55,250	.....
Ecuador	4,495	521	105	225	1,000	.....
Peru	.....	4,202	2,120	5,087	2,600	.....
Uruguay	.....	.....	.....	3,434	75	.....
Venezuela	9,159	10,976	2,543	1,734	200	.....
B. India	77,590	4,865	943	102,330	6,215	.....
B. Malaya	.....	2,662	543	373	.....	.....
China	6,164	14,840	4,924	265,463	1,400	.....
Java & Madura	9,076	.....	.....	.....	.....	.....
Other Netherland E. Indies	350	.....	.....	29	.....	.....
Hong Kong	.....	.....	.....	112,200	.....	.....
Japan	34,659	170	85	140,010	8,200	.....
Philippine Islands	105,715	3,522	585	14,317	13,400	100
Siam	.....	445	88	.....	.....	.....
Soviet Russia in Asia	40,777	.....	.....	61	.....	.....
Australia	.....	2,189	386	195,365	5,717	.....
F. Oceania	.....	.....	.....	372	.....	.....
N. Zealand	.....	350	45	9,743	9,725	.....
B. E. Africa	2,818	.....	.....	.....	.....	.....
Union of South Africa	6,231	10,601	2,939	5,870	.....	.....
Other B. S. Africa	.....	.....	.....	147	.....	.....
Egypt	.....	.....	.....	50	.....	.....
Liberia	.....	612	57	.....	.....	.....
Mozambique	547	4,189	773	163	.....	.....
Canary Islands	.....	.....	.....	.....	2,277	.....
Total Quantities	**1,512,567**	.....	.....	**2,171,385**	**189,122**	**82,770**
Total value	**73,677**	**267,284**	**49,696**	**179,837**	**21,525**	**5,971**
Shipments from U. S. to:						
Alaska	.....	.....	.....	.....	.....	.....
Hawaii	35,629	15,349	4,212	54,859	674	23,420
Porto Rico	59,281	11,658	2,569	25,923	2,100	18,939

nage of Iron and Steel wire shipped in April and about one-third more Galvanized. There was a slight falling off in Canadian purchases of our Barbed Wire, balanced by appreciable increases in Insulated, in Wire Nails, and a considerable increase in all the wire product divisions.

May shipments of plain wire to Mexico fell off about 50% as compared with April, but exports of Galvanized were more than double those of the previous month and shipments of insulated were unusually heavy. Argentina shows marked increase in May receipts of both Plain and Galvanized, with little change in other respects.

Other shipments to foreign countries were widely scattered and of little significance.

SCOTT



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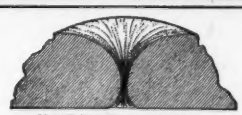

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BAKERS

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CLEANING COMPOUNDS

Oakite Products, Inc., N. Y.

CRANES

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Chilled Iron

The Waterbury Wire Die Co., Waterbury, Conn.

DIES—Diamond

Bellet & Bouvard, N. Y.
Cochaud Wire Die Co., New York.
Diamond Die Co. of America, N. Y. C.
Driver-Harris Co., Harrison, N. J.
F. Krause & Co., Inc., Jersey City, N. J.
Union Wire Die Corp., New York, N. Y.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Works, New York.
The Waterbury Wire Die Co., Waterbury, Conn.

DIES—Repairs & Re-Cutting

Bellet & Bouvard, N. Y.
Cochaud Wire Die Corp., New York
Diamond Die Co. of America, N. Y. C.
F. Krause & Co., Inc., Jersey City, N. J.
Urdika Wire Die Co., N. Y. C.
Vianney Wire Die Wks., N. Y.

DRAWING COMPOUNDS

Oakite Products, Inc., N. Y.

FURNACES—Wire Annealing

Vaughn Machinery Co., Cuyahoga Falls, O.

GAUGES—Wire

A. Waldeck & Co., Cleveland, Ohio.

LATHES—Die Reaming

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—Wire Drawing

Adam Cook's Sons, Inc., New York City.

MACHINERY—Armoring (Cable, Wire, Hose)

J. I. Bernitz, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson.

MACHINERY—Balancing

Herman A. Holz, New York.
Riehle Bros.
Henry L. Scott Co., Providence. R. I.

MACHINERY—Bundling

J. I Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson.

MACHINERY—Cutting

J. I. Bernitz, New York.
The F. B. Shuster Co., New Haven, Conn.

WIRE WEAVING LOOMS

M. A. Irmischer, New York.

MACHINERY—Coiling

J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Chain Forming

J. I. Bernitz, New York.
M. A. Irmischer, New York.

MACHINERY—Electric Chain Welding

J. I. Bernitz, New York.
M. A. Irmischer, New York.

MACHINERY—Enameling

Coilton Electric Mfg. Co., Easton, Penn.

MACHINERY—Forming

J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. D. Kilmer & Co., Cleveland, Ohio.

MACHINERY—Gem Clip

J. I. Bernitz, New York.
M. A. Irmischer

MACHINERY—Insulating

American Insulating Machinery Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.

MACHINERY—Nail

J. I. Bernitz, New York.
M. A. Irmischer, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Pointing

M. A. Irmischer, New York.
Morgan Construction Co., Worcester, Mass.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Pin & Needle

J. I. Bernitz, New York.
M. A. Irmischer, New York.

MACHINERY—Screw Wire

Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Second-hand

Jesse Atherton, Providence, R. I.

MACHINERY—Spring Making

J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple

J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.

MACHINERY—Straightening

J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.
M. A. Irmischer, New York.
F. B. Shuster Co., New Haven, Conn.

MACHINERY—Stranding

J. I. Bernitz, New York.
M. A. Irmischer, New York.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson.

MACHINERY—Spooling

American Insulating Machinery Co., Philadelphia, Pa.
M. A. Irmischer, New York.
Chas. Koegel Sons, Co.

MACHINERY—Panning

American Insulating Machinery Co., Philadelphia, Pa.

MACHINERY—Testing

Herman A. Holz, New York.
Riehle Bros., Phila., Pa.
Henry L. Scott Co., Providence, R. I.

MACHINERY—Winding

J. I. Bernitz, New York.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Drawing

American Insulating Machinery Co., Philadelphia, Pa.
Broden Const. Co., Cleveland, Ohio.
Burlingame Machine Co.
Kratos Wks., N. Y. C.
Morgan Construction Co., Worcester, Mass.
M. A. Irmischer, New York.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
The Vaughn Machinery Co., Cuyahoga Falls, Ohio.

NEUTRALIZING COMPOUNDS

Oakite Products, Inc., N. Y.

REELS—Annealing

American Pulley Co., Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

PRESSES—Rivet & Bolt

M. A. Irmischer, New York.

SOAPS—Wire Drawing

R. H. Miller Co., Homer, N. Y.

SPOOLS—Wire & Cable

American Pulley Co., Philadelphia, Pa.
Apco-Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TRUCKS

Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

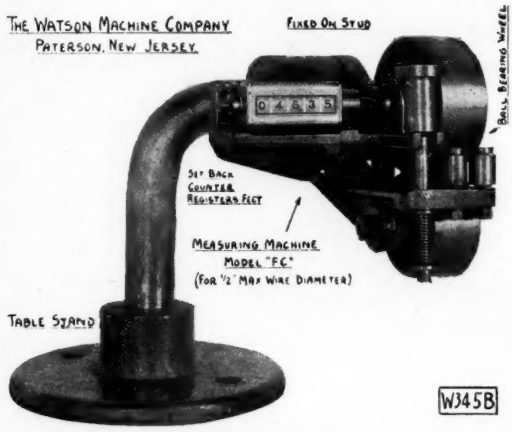
This is a carefully classified index of concerns who specialize in this industry and who advertise regularly in WIRE & WIRE PRODUCTS. Please mention WIRE when writing to these firms.

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

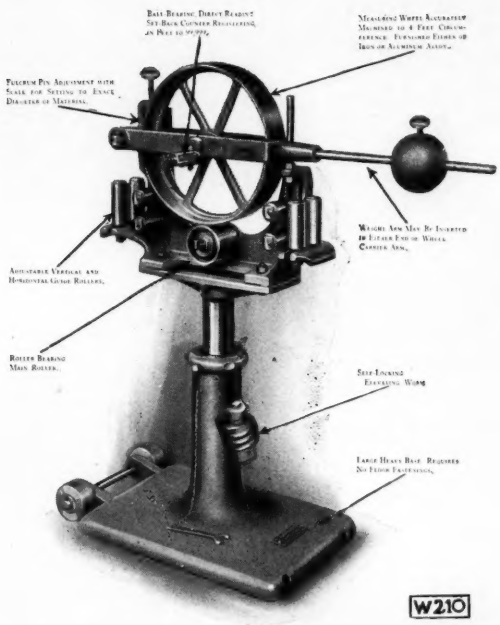
ENGINEERS - FOUNDERS - MACHINISTS



Model "FC" Measuring Machine

(For Diameters Under 0.5 Inch)

With or Without Table Stand



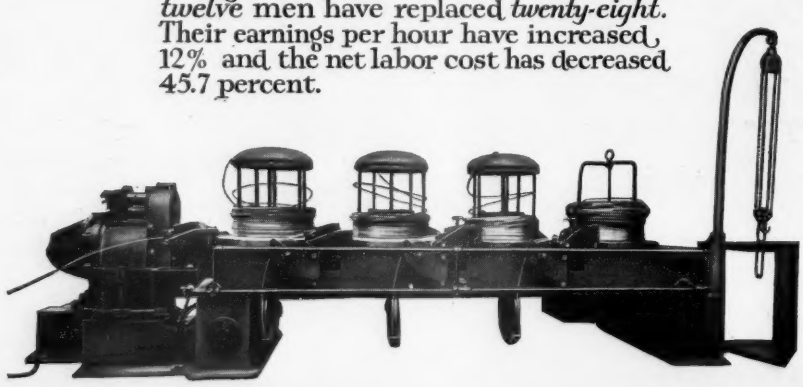
Model "DC" Measuring Machine

Built in Two Sizes for Max. Cable Diameters of 1" and 3" With Alloyed or Iron Wheel With or Without Floor Stand.

ELECTRICAL WIRE AND CABLE
WIRE ROPE and CORDAGE MACHINERY

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

Through this installation of
Morgan Connor Wire Machines
twelve men have replaced *twenty-eight.*
Their earnings per hour have increased 12% and the net labor cost has decreased 45.7 percent.



MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.